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Discovering ICT solutions for knowledge transfer issues in co-creation value networks
a multiple case study and Delphi study combined

van der Zandt, H.V.N.

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Discovering ICT solutions for knowledge transfer issues in co-creation value networks

A multiple case study and Delphi study combined

Master Thesis
H.V.N. van der Zandt

In partial fulfilment of the requirements for the degree of
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Supervisors:
Prof. dr. ir. J.J.M. (Jos) Trienekens, TU/e, Information Systems IE&IS
Prof. dr. R.J. (Rob) Kusters, TU/e, Information Systems IE&IS

Tutor:
S. (Samaneh) Bagheri, MSc. TU/e, Information Systems IE&IS

Assessment committee:

Prof. dr. ir. J.J.M. (Jos) Trienekens, TU/e, Information Systems IE&IS

Prof. dr. R.J. (Rob) Kusters, TU/e, Information Systems IE&IS

Dr. M. (Massimiliano) de Leoni, TU/e, Information Systems WSK&I

S. (Samaneh) Bagheri, MSc. TU/e, Information Systems IE&IS

Preface

This Master Thesis is the result of my graduation project as part of the Master program of the Business Information Systems Master at Eindhoven University of Technology. The completion of this Master Thesis would not have been possible without the support and contributions of many people, to whom I am truly grateful.

First I would like to thank my tutor, Samaneh Bagheri, MSc. For her dedication and excellent guidance throughout this project. Similarly I would like to thank my supervisors Prof. dr. ir. Jos Trienekens and Prof. dr. Rob Kusters for their involvement, advice and support throughout the entire project. I would also like to thank Dr. Massimiliano de Leoni accepting to be in my assessment committee.

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And last but not least I would like to thank my parents, Leo van der Zandt and Yvette van der Zandt, my sister, Nicole van der Zandt and girlfriend, Relinde de Zwart, I love all of you from the bottom of my heart for all of your encouragement and support.

Hugo van der Zandt							May 2016

Abstract

Research context

Service dominant logic is becoming an increasingly relevant concept and refers to increased customer involvement in value creating processes, where the role of producer and consumer is not clearly defined and value is co-created. Related to *service dominant logic* is the concept of *integrated solutions*, which are value propositions that combine tangible products and intangible services. These offerings are often co-created with partners and customers.

The combination of partners and customers in a network setting is referred to as a *co-creation value network* in this study. This type of networks is an emerging field in literature as well as in practice.

Co-creation requires knowledge to be transferred between all actors in these networks. Even though knowledge transfer has received considerable attention in the context of these networks, it often faces issues.

Research objectives

In this study the *knowledge transfer issues* that occur in the context of *co-creation value networks* are identified and a framework is developed. This framework is then used as input for the discovery of ICT functionality types that can solve the identified *knowledge transfer issues* in these networks. The effectiveness of this process, for achieving business-IT alignment, is then assessed.

Research methodology and results

To determine which *knowledge transfer issues* occur in *co-creation value networks,* a multiple case study was conducted. In this study eight co-creation value networks were studied. A comprehensive classification framework was methodologically developed for the identification of *knowledge transfer issues*. This classification framework was developed in two steps. First a structured literature review was conducted in the related field of *business networking*. The review results were then synthesized into a framework, using a structured classification process that employs group meetings; the Metaplan technique.

The classification framework was then validated through conducting semi-structured interviews with experts from the eight cases. The validated classification framework is referred to as the KTI framework and contains 29 knowledge transfer issues.

The ten most relevant issues discovered during the validation of the classification framework were used as input for a two round Delphi study. The Delphi method is an iterative and flexible method for structuring group communication, in which the participants remain anonymous to each other to eliminate undesirable psychological effects that can occur during group sessions. The Delphi study was aimed at the discovery of ICT functionalities that can help with solving the ten most relevant *knowledge transfer issues*. The Delphi study was conducted with the same experts that participated in the validation of the classification framework. During the first round the experts suggested 120 ICT functionalities. In the second round the experts gave indications for the *usefulness* and *importance* of these suggestions and suggested an additional eleven solutions. The 131 suggested ICT functionalities were structured using the Metaplan technique. Through this an overview was created of ICT functionality types and their relative importance for solving particular knowledge transfer issues. Through these results, and through statements given by the experts at the end of the second round, it was possible to asses that the process used in this study is effective for achieving business IT alignment.

Contribution to literature

The KTI framework contributes to literature because it is more comprehensive than existing frameworks related to *knowledge transfer issues*. The KTI framework further contributes to literature because it has been validated in the context of *co-creation value networks*. The whole methodology used throughout the study contributes to literature on achieving business IT alignment in the context of network environments.

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Abbreviations

Abbreviation	Explanation
CA	Content analysis
DCA	Deductive content analysis
KTI	Knowledge transfer issue
CKTI	customer-knowledge transfer issues
CKM	Customer knowledge management
CK	Customer knowledge
VN	Value network
CC-VN	Co-creation value network
BIA	Business-IT alignment
ICT	Information communication technology
S-D logic	Service-dominant logic
G-D logic	Good-dominant logic
SLR	Systematic literature review
GS	Google Scholar
TM	Transactive Memory
PSS	Product-Service Systems
SODSC	Service Oriented Demand Chains and Supply Chains

Glossary

Definition	Explanation
Co-creation	The joint production of value for both customers and firms alike through an interactive process.
CKM	The continuous process of generating, disseminating and using knowledge from and about customers, to learn from them and understand their specific needs.
CC-VN	A set of actors which adaptively collaborate in long-term relations with their customers, which pursue a joint strategy aimed at creating customer value and therefore integrate their resources and knowledge, and interact through complex dynamic, tangible and intangible, exchanges to offer integrated solutions.
BIA	The best possible use of IT resources to meet enterprise objectives.
Tacit knowledge	Knowledge has a personal quality, which makes it hard to formalize and communicate, such as intuition.
Explicit knowledge	knowledge that is codifiable and transmittable in formal, systematic language.
S-D logic	The paradigm where value is co-created and the focus is on customer experience. Customers play an active role. S-D logic uses goods (tangible resources) as a service distribution mechanism.
G-D logic	The paradigm where value is created through exchange of goods and money. The customer plays a passive role.
Delphi method	An iterative and flexible method for structuring group communication, in which the participants remain anonymous to each other to eliminate undesirable psychological effects that can occur during group sessions.
The research group	This group consists of the two supervisors, the tutor and the author stated on the cover of this document.
The bandwagon effect	The bandwagon effect can occur when someone adjusts their own opinion to that of the majority of the group or a dominant personality within the group.

1 Introduction

In this chapter the context of the problem will be given, followed by the problem statement. It also presents the intended audience, the research objectives and research questions, the methodology used, the scope and structure of this Master Thesis.

1.1 Problem context

Most firms are constantly looking for ways to increase their competitive advantage. To gain competitive advantage in today's business environment, firms should change their focus from supplying customer demand to creating value for customers (Sherer, 2005). To create value, a firm strongly depends upon its core capabilities; which are limited due to the complexity of today's business environment (Kothandaraman & Wilson, 2001). Hence, firms must find partners with complementary core competences to increase value and manage these partnerships so that every partner benefits (Kothandaraman & Wilson, 2001). Such a network of collaborating partners can be called a Value Network (VN). "It is argued that value-creating networks will take businesses into a competitive domain where competition will shift to the network level from the firm level" (Kothandaraman & Wilson, 2001).

Customers no longer receive value through products and services alone (Prahalad & Rasmaswamy, 2004). The value that customers perceive, when trying to satisfy their unique preferences, originates from the total sum of personal experiences they get from interacting with a network of firms and consumer communities (Prahalad & Rasmaswamy, 2004). The VN needs to respond to individualized and changing customer needs to create the most value for the customer (Sherer, 2005). One way to do this is by making use of customers' experiences, allowing integrated solutions to be co-created (Bagheri, Kusters, & Trienekens, 2015). However, before a firm can start co-creating, it needs to extract and manage knowledge from their customers about their needs. The continuous process of generating, disseminating and using knowledge from and about customers, to learn from them and understand their specific needs, is referred to as customer knowledge management (CKM) (Gibbert, Leibold, & Probst, 2002) (Garcia-Murillo & Annabi, 2002) (Rollins & Halinen, 2005). Because the customers hold this knowledge, they could be viewed as a company's most important partner (Gibbert, Leibold, & Probst, 2002). The CKM lifecycle has four main processes: creation, storage/retrieval, transfer and application (Bagheri, Kusters, & Trienekens, 2015).

1.2 Problem statement

There exists literature about CKM and co-creation, but the existing literature about CKM in the context of VNs is limited (Bagheri, Kusters, & Trienekens, 2015). This thesis aims to contribute to the existing literature by examining the knowledge transfer issues (KTIs) that companies in Co-Creation Value Networks (CC-VNs) experience within their knowledge transfer processes.

This thesis is linked to a PhD research which investigates business-IT alignment (BIA) in the field of CKM in VN settings. BIA refers to the best possible use of IT resources to meet enterprise objectives (Bagheri, Kusters, & Trienekens, 2015). Because of this, emphasis will be put on KTIs which concern the transfer of customer-knowledge. Additionally, once the KTIs that occur in VNs have been identified, it will be investigated which kind of information communication technology (ICT) functionalities can play a role in solving these KTIs. To do this a methodology is developed in this thesis which uses a KTI classification framework as a basis to investigate possible ICT functionalities.

1.3 Intended audience

The contents of this thesis are relevant for people whose organization has tight relations with partners and customers. More specifically if the exchange of knowledge is an important aspect of this relationship. This thesis can also be interesting for academics who are eager to know more about KTI that occur in VNs.

1.4 Research objectives and research questions

The first objective of this thesis is the development and validation of a KTI framework for CC-VN contexts. This objective is divided into two stages. Stage one is aimed at the development of the KTI classification framework[1]. In order to benefit from existing literature on KTIs, RQ 1.0 and RQ 1.1 have to be answered. Stage two is aimed at validating the KTI classification framework in the context of CC-VNs and assessing how the KTI framework compares to related frameworks. To achieve this RQ 2.0 and RQ 2.2 have to be answered because there is no existing literature on KTIs in the context of CC-VNs. Answering RQ 2.1 is important for the second research objective, because through answering RQ 2.1 it is possible to determine which KTIs are most relevant to practitioners and should be used as input for the second research objective.

> **RQ 1.0**: Which KTIs are mentioned in related literate?

> **RQ 1.1**: What is a suitable and feasible method for classifying KTIs from existing literature?

> **Research output 1**: KTI classification framework

> **RQ 2.0**: Which KTIs occur in CC-VNs (validation of the KTI classification framework)?

> **RQ 2.1**: Which KTIs are considered most important by practitioners?

> **Research output 2:** Validated, enriched KTI framework

> **RQ 2.2**: How does the KTI framework compare to related frameworks?

The second objective is to assess if the type of process used in this thesis is effective for achieving business-IT alignment in CC-VNs. Where 'the type of process' refers to: using the KTI framework as input for the discovery of ICT solutions. This objective will also be divided into two stages: Stage one, the discovery of solutions in the form of ICT functionalities, to achieve this RQ 3.0 will have to be answered. Stage two, establishing if the process that has been used throughout the study has been effective, to achieve this RQ 4.0 will have to be answered.

> **RQ 3.0**: What types of ICT functionalities can help to solve the most relevant KTI in CC-VN contexts?

> **Research output 3:** A collection of ICT functionality types

> **RQ 4.0**: Has the process used in this study been effective?

1.5 Scope

VNs that do not include the customer as an actor are considered out of scope for this thesis. This thesis focusses on CC-VNs. The KTIs that are studied in this thesis will also be limited to the KTIs that occur in CC-VNs. This means that KTIs which occur within an organization are considered out of scope. Because co-creation requires knowledge from customers emphasis is put on customer-knowledge transfer issues

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[1] Throughout this thesis 'KTI classification framework' refers to the not-validated 'KTI framework'.

(CKTIs). The scope of KTIs is however not limited to CKTIs, more general KTIs that do not specifically involve customer knowledge are also included.

The solutions types to KTIs that will be discovered during the two round Delphi study will be focused on ICT functionalities. This is because of the second research objective of assessing if the process used in this thesis is effective/appropriate for achieving business-IT alignment.

Furthermore, data is only be collected in Dutch organizations (the partners of these organizations can be international).

1.6 Contributions

This thesis contributes to literature on KTIs by offering a comprehensive framework of possible KTIs within a CC-VN, these KTIs include both tacit and explicit knowledge transfer. It further contributes to literature on KTIs and literature on network environments by providing validation of the KTI classification framework in the context of CC-VNs and proposing ICT functionalities that can play a role in solving KTIs. The whole methodology used in the thesis contributes to literature on achieving BIA in the context of network environments.

1.7 Methodology

Establishing what the currently known KTIs are was used as a starting point for this study. This was achieved through analyzing related scientific literature through a Systematic Literature Review (SLR). Because choosing an ad hoc approach for this may cause *selection bias* to arise, where only certain preferable papers are included in the study, a SLR prevents this. A SLR is done by using a predefined protocol to find and include literature that will be analyzed, because "unless a literature review is thorough and fair, it is of little scientific value" (Kitchenham & Charters, 2007). After data was collected through the SLR the data was classified. This from of synthesis was done using the Metaplan method. After the currently known KTIs were identified and classified, their existence in the context of CC-VNs was validated through a multiple case study that used semi-structured interviews as a data collection method. These interviews were conducted with experts that operate in CC-VNs, simultaneously indications for the importance of each individual KTI were acquired.

Once the most relevant KTIs were identified, a two round Delphi study was applied to find ICT solution types to these KTIs. For this two round Delphi study the same experts were interviewed. The study produced output in the form of ICT functionalities that can help in solving KTIs and an indication of how important experts consider these solutions for their CC-VN. The outline is summarized in Figure 1. At the end of the second Delphi round the participants were also asked to answer questions to establish whether the used methodology was effective.

1.8 Thesis structure

This thesis is structured as follows: In Chapter 2 the theoretical background for this thesis is given, in Chapter 3 the methodology used to achieve the research objectives is explained, in Chapter 4 the results that have been made a presented, in Chapter 5 the used methodologies and associated results are discussed and in Chapter 6 the conclusions of and future work related to this thesis are presented.

First research objective
- SLR + Metaplan sessions
- KTI classification framework
- (Validation) Multiple cases study, Semi-structured interviews
- Validated KTI framework + enrichment + importance indications

Second research objective
- Delphi round 1
- Delphi round 2
- Assessed process
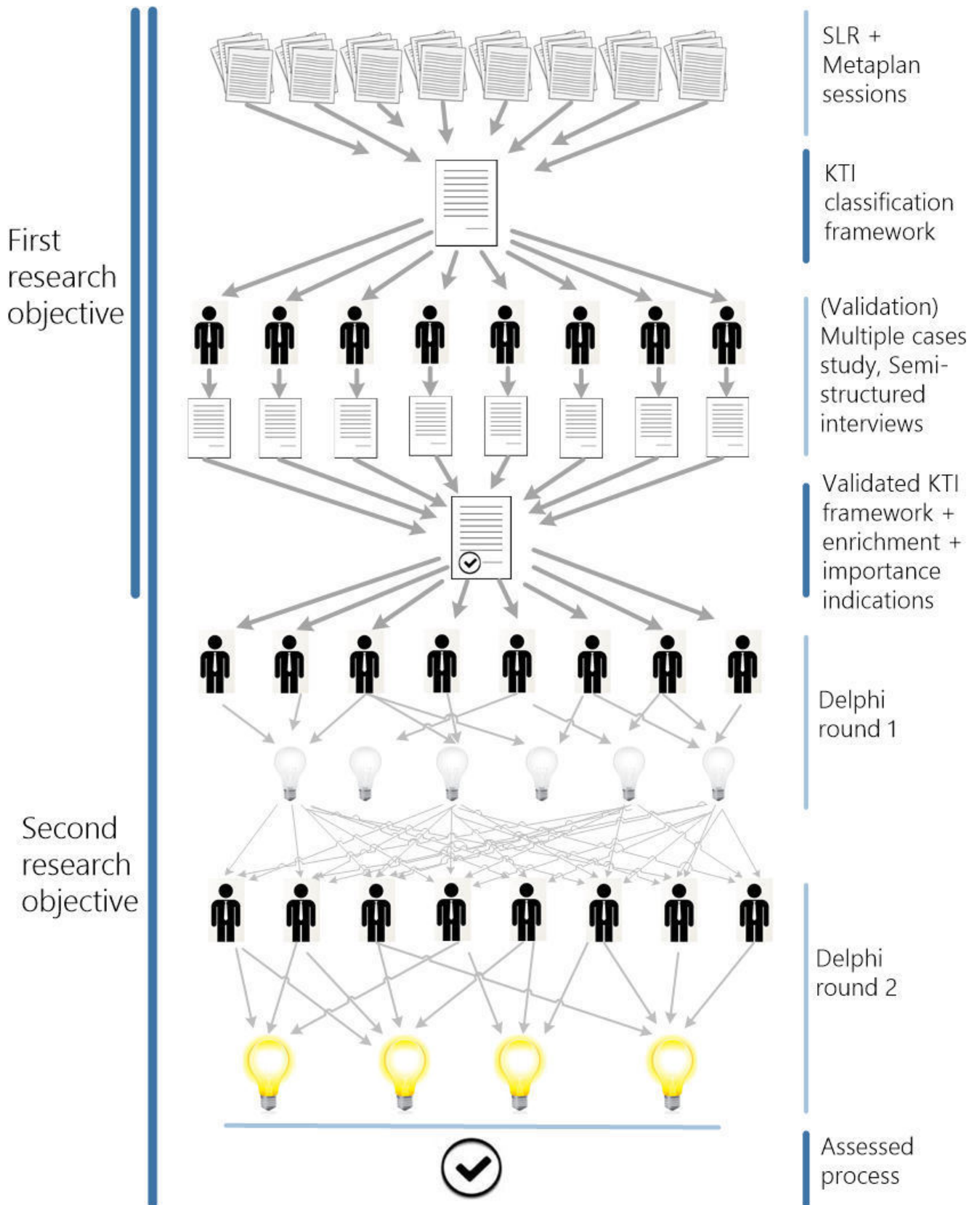
Figure 1 Study outline

2 Theoretical background

This chapter will review the relevant literature for this thesis, which is related to subjects such as co-creation, CC-VNs, CKM and KTIs.

This chapter begins with reviewing literature that describes the concept of *Service-Dominant logic* (S-D logic) and the associated view on value creation, to provide a context in which the other topics can be placed. Then integrated solutions and co-creation are reviewed as these concepts facilitate value creation though increased customer involvement. These concepts do not commonly occur in traditional supply chains but in CC-VNs. Because the notion of CC-VN is important for this thesis the difference between traditional supply chains and CC-VNs will be explained. Value creation through co-creation also requires CKM, which involves transfers of knowledge from one party to another. These transfers can be affected by issues referred to in this thesis as KTIs. Because KTI are an important aspect of this thesis, examples of KTI and solutions that are mentioned in literature, are reviewed.

2.1 Value focus, G-D logic and S-D logic

In the construction of any competitive strategy value should be a key driver rather than pure cost (Peppard & Rylander, 2006). Since "Customer perceived value is considered fundamental to company competitive advantage" (Aarikka-Stenroos & Jaakkola, 2012). According to Vargo et al. (2008) there are two general meanings of value: *"value-in-exchange"* and *"value in use"*. The former is the traditional view and is referred to as *Good-Dominant logic* (G-D logic), the latter alternative view is referred to as S-D logic (Vargo, Maglio, & Akaka, 2008) (Lusch, 2011). Marketing scholars argue that service provision, rather than goods, is the dominant logic that is fundamental to economic exchange to any type of organization, industry and sector (Windahl & Lakemond, 2010).

In G-D logic, activities of a firm create value which is distributed through exchange of goods and money (Vargo, Maglio, & Akaka, 2008). Inherent to G-D logic is an excessive focus on the firm's value creation activities with customers playing a passive role (Chathoth, Altinay, Harrington, Okumus, & Chan, 2013). While in *S-D logic* value is always jointly co-created by providers and beneficiaries (Vargo, Maglio, & Akaka, 2008) (Lusch, 2011). Co-creation can be defined as: "[...] the joint production of value for both customers and firms alike through an interactive process" (Chathoth, Altinay, Harrington, Okumus, & Chan, 2013). S-D logic uses goods (tangible resources) as a service distribution mechanism (Lusch, 2011). Value creation in the context of S-D logic requires resources from a firm, its customers, suppliers, employees, stockholders and other network partners (Vargo, Maglio, & Akaka, 2008). Customers (often the aforementioned beneficiaries) determine the derived value (Lusch, 2011) (Windahl & Lakemond, 2010) when, after a process they are, or feel, better off than before (Grönroos, 2008). This means that the value of a value-in-use offering is relative to the subjective perceptions and experiences of a customer (Aarikka-Stenroos & Jaakkola, 2012). Aarikka-Stenroos and Jaakkola (2012) state that multiple benefits can be realized for customers through value-in-use, such as increased reliability, time savings, compatibility with future solutions and cost reductions. Organizations have to adopt a point of view that allows individual customers, through interaction and active dialogue, to actively co-construct their own consumption experiences (Prahalad & Ramaswamy, 2003) and thereby co-create value-in-use for themselves (Aarikka-Stenroos & Jaakkola, 2012) (Grönroos, 2008).

2.2 Product-service systems and integrated solutions

Product-Service Systems (PSS) are a specific type of value proposition that can be offered to, or co-created with, customers (Tukker & Tischner, 2006). This is done through a relational process among partners and customers (Bagheri, Kusters, & Trienekens, 2015). A PSS is an integrated combination of tangible products and intangible services (Baines, et al., 2007), provided by multiple actors (Jaakkola &

Hakanen, 2013), which jointly fulfill the needs of end customers (Baxter, Roy, Doultsinou, Gao, & Kalta, 2009) (Tukker & Tischner, 2006) (Windahl & Lakemond, 2010). A PSS has a customer focus: the final functionality that a customer wants is used as a starting point of business development (Tukker & Tischner, 2006). Hence customers are more involved and the offering is customized (Windahl & Lakemond, 2010). A PSS extends the functionality of a product by incorporating additional services and lays emphasis on 'sale of use' rather than the 'sale of product' (Baines, et al., 2007). Changing the relationship with the customer from transactional to relational (Windahl & Lakemond, 2010). Because of this, the customer benefits from restructuring of the risks, responsibilities and costs that are associated with ownership (Baines, et al., 2007). The term *integrated solution* is often used interchangeable with the term PSS and is defined as: offerings of products and services that meet customer-specific needs (Jaakkola & Hakanen, 2013) (Windahl & Lakemond, 2006). To provide these solutions organizations can integrate and apply resources with partners, to co-create value in networks (Hakanen, 2014). Section 2.3 *Network Context* elaborately reviews literature related to these kinds of networks.

2.3 Network context

The goal of this thesis is to identify KTIs in the context of CC-VNs and propose solution types to these issues. A very important aspect of this goal is the context. The context will be described by looking at the different types of environments in which organizations operate and how they are different from another. Starting with supply/value chains, which refers to managing supply through a chain of suppliers in a linear fashion, from raw materials to the consumption of the finished product (Sherer, 2005). An analogy the supply process is that of a flow, where suppliers are located upstream and physical goods are moved to customers downstream (Sherer, 2005). However, the flow that often gives competitive advantage is the information flow, which flows from the customer to the supplier (Sherer, 2005). Figure 2 depicts a typical supply/value chain.
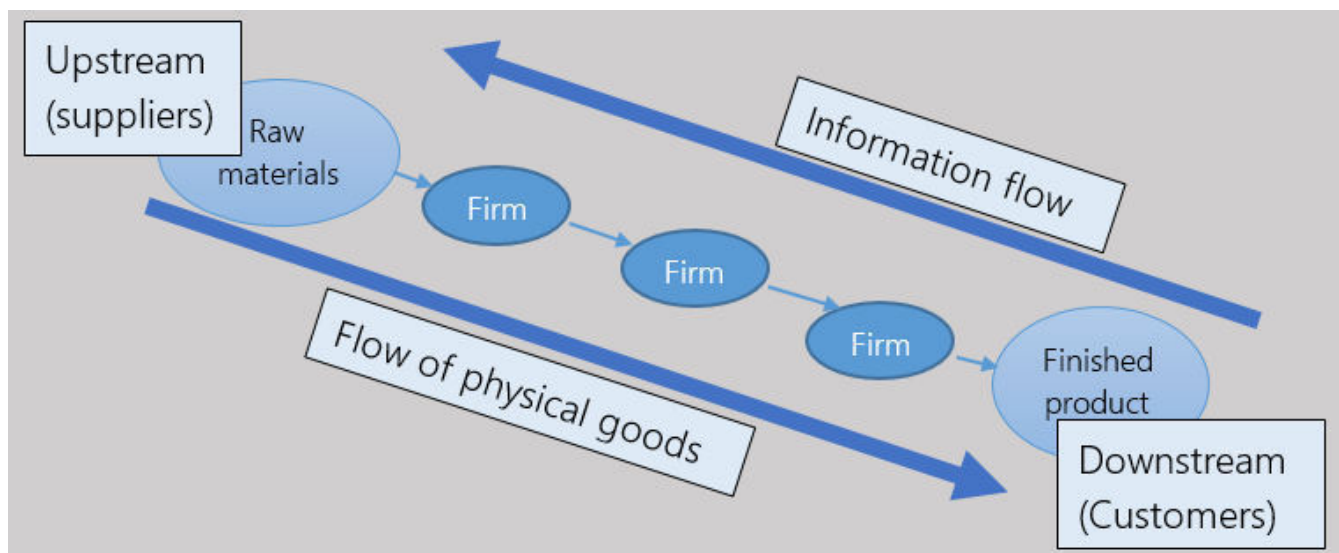
Figure 2 A typical supply/value chain

A chain is particularly suitable for portraying traditional industries such as manufacturing, with their value creating logic as a linked chain of activities; however, as product and services become dematerialized the chain itself no longer has physical dimensions and the chain concept becomes inappropriate (Peppard & Rylander, 2006). In other words, a supply chain is more related to G-D logic. In less traditional sectors value is no longer created by a product passing through every link in a chain, it is co-created by complementary players in a network (Peppard & Rylander, 2006), that provide complementary products (Windahl & Lakemond, 2006). Such a network is often referred to as a VN (also referred to business

networks or ecosystems). Many authors that publish on the subject state and adopt their own definition of 'Value Network', a chronological overview is given in Table 1

Author	Definition
(Christensen & Rosenbloom, 1995)	"Firms which design and assemble computers at the next higher level may buy their integrated circuits, terminals, disk drives, IC packaging and power supplies from unique sets of firms focused upon manufacturing and supplying those particular products. We call this nested commercial system a value network."
(Allee, 2000)	"A value network generates economic value through complex dynamic exchanges between one or more enterprises, its customers, suppliers, strategic partners, and the community."
(Kothandaraman & Wilson, 2001)	"Value-creating networks are firms that come together to create customer value."
(Peppard & Rylander, 2006)	"The grouping of expertise within organizations will not be the same as before; it will differ depending on what part of the telecommunications industry the organization is located in, and the business model it has chosen to develop. This fragmentation results in a radical deconstruction of the industry where complex relationships will need to be formed between different players in order to deliver services to end customers. These can be represented by a network of connected entities: the value network."
(Heikkinen, Mainela, Still, & Tähtinen, 2007)	"A focal net consists of all the actors the focal firm perceives as relevant and within the focal firm's network horizon [...] In this study, the concept of net is utilized to depict an interrelated group of actors pursuing a joint strategy within a larger network (Möller & Halinen, 1999)."
(Allee, 2008)	"A value network is any set of roles and interactions in which people engage in both tangible and intangible exchanges to achieve economic or social good".
(Eisingerich, Rubera, & Seifert, 2009)	"We broadly define the network under study as the set of formalized cooperative relationships between competitors and collaborators along which information and knowledge can be transmitted. Consistent with Gnyawali and Madhavan (2001)".
(Lusch, Vargo, & Tanniru, 2010)	"A value network is a spontaneously sensing and responding spatial and temporal structure of largely loosely coupled value proposing social and economic actors interacting through institutions and technology, to: (1) co-produce service offerings, (2) exchange service offerings, and (3) co-create value. The supply chain is a sub-part of the value network, embedded within these value networks."
(Jaakkola & Hakanen, 2013)	"We use the term solution network to denote the set of actors, i.e. the multiple suppliers and the customer, that are connected to each other for the purpose of integrating their resources to co-create value through solutions.
(Bagheri, Kusters, & Trienekens, 2015)	"[...] the characteristics of a PSS value network, i.e. collaboration with both partners and customers as well as the customer experience view on providing integrated solutions."

Table 1 Chronological overview of value network definitions

The 'older' definitions of VNs do not emphasize that the customer is part of the VN, which suggests it is related to G-D logic. Figure 3 depicts a minimalistic view of such a VN: a firm that collaborates with a partner. The customers that the VN services are not included in the VN itself. Which means no co-creation occurs and no use is made of the knowledge of these customers. Recognizing customers as a knowledge source has several benefits such as: customer success, innovation and organizational learning (Gibbert, Leibold, & Probst, 2002). Meaning the customer could be considered an important partner in the value creation process (Gibbert, Leibold, & Probst, 2002).
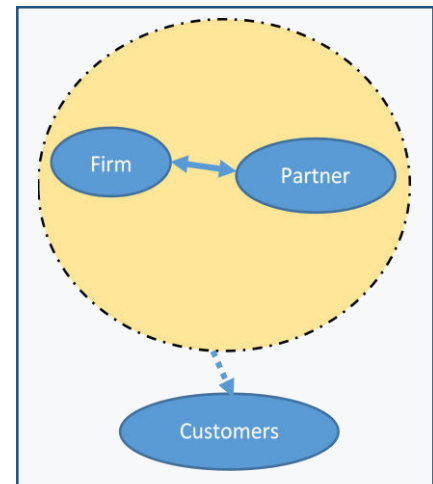
Figure 3. Minimalistic representation of a VN
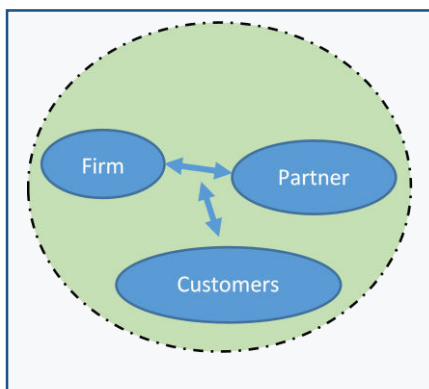
Figure 5 Minimalistic representation of a CC-VN

Seeing customers is an actor in the VN is an important characteristic of S-D logic. Shifting the emphasis to long-term relationships with customers instead of single transactions (Windahl & Lakemond, 2006). To make a distinction between VNs that recognize their customers as a partner and VNs that do not, the former will be referred to as a CC-VN. Figure 4 depicts a minimalistic view of a CC-VN. The customer actively provides input regarding his needs to other members of the network. Information can be communicated directly to all network members or to a member that communicates it to other members of the network.

Value co-creation occurs through a dyadic problem solving process encompassing five key activities: (I) diagnosing the needs of customers, (II) designing and producing the solution, (III) organizing the process and resources, (IV) managing value conflicts, and (V) implementing the solution (Aarikka-Stenroos & Jaakkola, 2012). Removing the customer would imply there is no collaborative process of value co-creation as the customer plays a vital role in activity (I). In this sense VNs differ from CC-VNs. It is important to note that in practice, the focal firm (a particular organization within a CC-VN that is being studied) determines the network horizon through what it perceives as the boundary of the network (Heikkinen, Mainela, Still, & Tähtinen, 2007) (Windahl & Lakemond, 2006).

This thesis maintains the following definition for the term CC-VN:

> *A set of actors which adaptively collaborate in long-term relations with their customers, which pursue a joint strategy aimed at creating customer value and therefore integrate their resources and knowledge, and interact through complex dynamic, tangible and intangible, exchanges to offer integrated solutions.*

The definition of the term CC-VN is largely build up out of the definitions presented in Table 1. With the exception of the definition used by Christensen & Rosenbloom (1995), as that definition is more related to G-D logic. The term 'actors' (Lusch, Vargo, & Tanniru, 2010) (Jaakkola & Hakanen, 2013) is included as it is abstract and implies there are many possible compositions for a CC-VN. The term 'adaptively' refers to how the collaboration can be adopted based on the needs of the customer to deliver customized integrated product services (Rasouli, Kusters, Trienekens, & Grefen, 2014). The phrase 'in long-term relations with their customers' is included as it is important for creating integrated solutions (Hakanen, 2014) (Windahl & Lakemond, 2010). To manage a network a '*joint strategy*' is included as this is relevant for managing networks (Heikkinen, Mainela, Still, & Tähtinen, 2007). The phrase '*creating customer value*' (Kothandaraman & Wilson, 2001), is added as this plays a central role in S-D logic, co-creation and integrated solutions. '*integrate their resources and knowledge*' (Jaakkola & Hakanen, 2013) refers to the activities required by the CC-VN to create customer value. Many activities are mentioned in the definitions presented in Table 1. These terms are chosen as they are abstract and imply that the exact required activities will depend on a particular CC-VN itself. The phrase '*interact through [...], tangible and intangible, exchanges*' (Allee, 2008) referred to sharing activities between actors, these can be both tangible, in the form of resources, and intangible, in the form of knowledge. The term 'complex dynamic' (Allee, 2000) is added to put emphasis on the complexity that can occur in CC-VNs in for example relationships (Peppard & Rylander, 2006). 'to offer integrated solutions' (Bagheri, Kusters, & Trienekens, 2015) is included as integrated solutions are strongly related to S-D logic and they are mentioned in relation to co-creation and networks (Hakanen, 2014).

2.3.1 SODSC framework
Rasouli, Kusters, Trienekens and Grefen (2014) developed the Service Oriented Demand Chains and Supply Chains (SODSC) framework, a framework of three related two-dimensional matrices, to structure various notions about networks and supply chains. The first matrix looks at how value is obtained, through supply chain capabilities or customer orientation (Rasouli, Kusters, Trienekens, & Grefen, 2014). The former being G-D logic and the latter S-D Logic. The second matrix looks at partnership characteristics between suppliers and other suppliers, and suppliers and customers. Customers can be seen as active or passive partners and relationships amongst suppliers as static or adaptive. The thrid matrix of the SODSC framework looks at control aspects. The first dimension makes a distinction between attracting customers with products or, a relational value obtainment process that empasizes customers experience; the second dimention makes a distinction between G-D logic inventory based control and S-D logic information based control (Rasouli, Kusters, Trienekens, & Grefen, 2014). Co-creating PSS through a *collaborative value network* (customers as active partnets and adaptive partnerships) requires control characterized as *relational* and *information-based* (Rasouli, Kusters, Trienekens, & Grefen, 2014).

2.4 Customer knowledge management
PSS/integrated solutions need to be designed from the clients' perspective and require early involvement with customers and changes in the organizational structure of the provider (Baines, et al., 2007). Customer focus is essential to (co-)create value because, to provide unique customer value the provider needs to have deep knowledge of customers' needs (Brax & Jonsson, 2009) (Frow & Adrian, 2007)

(Aarikka-Stenroos & Jaakkola, 2012). Customer knowledge can be seen as a prerequisite to achieving a shared understanding of customers' needs across a network (Bagheri, Kusters, & Trienekens, 2015). Managing the knowledge of customers allows corporations to more rapidly create value for the corporation, its shareholders and its customers (Gibbert, Leibold, & Probst, 2002). The continuous process of generating, disseminating and using knowledge from and about customers, to learn from them and understand their specific needs, is referred to as CKM (Gibbert, Leibold, & Probst, 2002) (Garcia-Murillo & Annabi, 2002) (Rollins & Halinen, 2005).

The CC-VN context differs from traditional settings: the setting moves to collaborative networks of partners and customers, and a focus on co-creation; little is known about CKM processes in this context (Bagheri, Kusters, & Trienekens, 2015). Bagheri, Kusters, & Trienekens (2015) present a conceptual framework for the Value Network Customer Knowledge Management (VN-CKM) lifecycle, which facilitates the co-creation of PSS. They characterize four iterative and continuous processes in this lifecycle in the context of CC-VNs namely: VN-customer knowledge (CK) creation, VN-CK storage/retrieval, VN-CK transfer, and VN-CK application, in which the main characteristics of processes are identified by a standard input-process-output model. For the input- and output- looks a distinction is made between tacit and explicit knowledge. 'Explicit' or codified knowledge refers to knowledge that is transmittable in formal, systematic language. On the other hand, 'tacit' knowledge has a personal quality, which makes it hard to formalize and communicate" (Nonaka, 1994). The lifecycle facilitates partners in a network, to get a shared understanding of customer needs (Bagheri, Kusters, & Trienekens, 2015).

2.5 Knowledge transfer

Exploring how the CC-VN context affects the transfer processes of CKM is one of the goals of thesis. This is done by looking in particular at KTIs, because value creation requires sharing of critical information (Aarikka-Stenroos & Jaakkola, 2012), value is only created when knowledge is located and transferred from its previous site and applied where it is needed (Alavi & Tiwana, 2002). The amount of input from customers that a firm receives depends, primarily, on how well the service provider manages to obtain customer feedback. It further depends on how well the service provider is capable, prepared and willing to register such customer input (Grönroos, 2012). This information sharing can be a complex task, identifying and understanding factors that influence it is critical (Yang & Maxwell, 2011). To discover issues that can influence the sharing of customer knowledge more generic types of KTIs are considered, of which CKTIs are a subset. In literature much is written about barriers/challanges/problems/issues that affect knowledge- exchange/sharing/flow/ transfer (Duan, Nie, & Coakes, 2010) (Lin, Wu, & Yen, 2012) (Pirkkalainen & Pawlowski, 2014) (Paulin & Winroth, 2013) (Yang & Maxwell, 2011) (Yang, Kang, & Cha, 2015) (Cumberland & Githens, 2012) (Nevo, Benbasat, & Wand, 2012) (Hong, Suh, & Koo, 2011) (Noll, Beecham, & Richardson, 2010) (Howard, Vidgen, & Powell, 2006) (Rosen, Furst, & Blackburn, 2007) (Hicks, Culley, & McMahon, 2006) (Haug, Stentoft Arlbjørn, Zacharissan, & Schlichter, 2013). Eventhough none of these publications focus specifically on a VN context or customer knowledge, but knowledge in general. The issues that are mentioned could occor in VNs; Because a network is still build up out of interpersonal and interorganisational relations, which are elbaborately discussed in aformentioned publications.

2.5.1 Examples of knowledge transfer issues and solutions

This section reviews KTIs that are mentioned in literature to illustrate the relevance and variety of KTIs and solutions to them. First it will be argued 'why' a particular KTI is relevant, after which proposed solutions from literature are reviewed for that particular KTI. To point out the wide range of possible solutions to KTIs, this section includes but is not limited to ICT related solutions.

Trust barrier

A lack of trust can be an impediment to collaborative efforts (Lusch, Vargo, & Tanniru, 2010). Trust can refer to how honest and credible a person is (Nevo, Benbasat, & Wand, 2012) or to an expectation of credibility and benevolence towards other relational parties in vulnerable situations (Yang, Kang, & Cha, 2015). When there is a lack of trust, there is a concern regarding self-serving behavior in relationships (Cumberland & Githens, 2012).

Trust solution

A solution proposed by Cumberland and Githens (2012) to encourage trust is to involve partners in the decision making processes, listening to their ideas and providing incentives for knowledge sharing. The trust barrier can be further reduced by making external entities the focal point of competition, creating a singleminded purpose between parties (Cumberland & Githens, 2012). Longer relationships should also be cherished because "[...] because repeated positive experiences generate higher levels of confidence and lessen the concern that the other party is self-serving" (Cumberland & Githens, 2012).

Culture barrier

Actors participating in knowledge transfer can be limited in their ability to access, share, and absorb knowledge effectively due to a separation by time, space, language and/ or cultures (Duan, Nie, & Coakes, 2010). On an organisational level, cultural distance manifests itself in the forms of differing viewpoints and values (Pirkkalainen & Pawlowski, 2014). Culture has a major influence on distributed work, which is particularly important when people of different background collaborate (Pirkkalainen & Pawlowski, 2014). Cultural barriers can cause misunderstandings and cultural differences in communication styles and knowledge sharing norms can cause tensions and frustrations (Rosen, Furst, & Blackburn, 2007).

Culture solution

Educate people involved about possible cultural differences in communication and conflict styles (Rosen, Furst, & Blackburn, 2007). Interacting with members from other teams via site visits or video-conferencing technology can help to create understanding of different cultures (Noll, Beecham, & Richardson, 2010).

Transactive memory barrier

A Transactive Memory (TM) enables a group of individuals to pool their specialised knowledge by knowing 'who knows what' (Alavi & Tiwana, 2002) (Rosen, Furst, & Blackburn, 2007). Individuals, with their respective internal memory, fuction as external memory for other individuals; who encode meta-memories about the memories of others (Nevo & Wand, 2005). This TM allows individuals to retrieve knowledge/expertise that is not personally owned by them but that they recognize as being owned by someone else (Alavi & Tiwana, 2002) (Rosen, Furst, & Blackburn, 2007). A TM primarily develops over time through transactions between individuals (Alavi & Tiwana, 2002) (Nevo & Wand, 2005). If development of TM is constrained the quality and/or effiency of knowledge integration suffers, as energy is spend to obtain complementary knowledge that might be readility available from another individual (Alavi & Tiwana, 2002) (Rosen, Furst, & Blackburn, 2007).

Transactive memory solution

Traditional TM heavily relies on tacit knowledge of individuals regarding 'who knows what'. To assist individuals in indentifying knowledge retainers, this tacit knowledge can be made explicit. A transactive memory can be supported by an information system (Nevo & Wand, 2005). Or by a document with individuals' knowledge profile and areas of expertise (Rosen, Furst, & Blackburn, 2007). Additionally there should always be an internal inquiery for knowledge, expertise or advise before resorting to external sources (Rosen, Furst, & Blackburn, 2007).

Hetrogenious information systems barrier

"[...] information technology and systems are intertwined with contemporary service ecosystems" (Lusch, 2011). A lack of compatibility/interoperability between heterogeneous systems is often mentioned in literature (Lin, Wu, & Yen, 2012) (Pirkkalainen & Pawlowski, 2014) (Madenas, Tiwari, Turner, & Peachey, 2015) (Yang & Maxwell, 2011). It refers to inability or difficulties in automatic information exchange between different systems (Hicks, Culley, & McMahon, 2006). Solving the problem through outsourcing can cause additional issues in cross-boundary information sharing, due to poorly written and poorly preserved documentation, additionally contractors can go out of business and fail to support information systems maintenance and changes (Yang & Maxwell, 2011).

Hetrogenious information systems solution

Standardization of systems will reduce the cost of implementation and maintenance of multiple systems, allowing organizations to work collaboratively without having to invest in implementing and maintaining multiple systems (Madenas, Tiwari, Turner, & Peachey, 2015). Service Oriented Architecture (SOA) can be used to develop systems that automate data exchange and bridge heterogeneous systems (Yang & Maxwell, 2011) (Madenas, Tiwari, Turner, & Peachey, 2015). However, sometimes the transaction volumes do not justify the investment required for completely interoperable systems (Archer, Wang, & Kang, 2008).

2.6   The literature gap

In this chapter the relevant literature for this thesis has been reviewed. First, S-D logic has been addressed and how integrated solutions and co-creation contribute to the creation of value. After that the concept of CC-VNs has been explained and how these are different from tradition supply chains, closing the paragraph with the definition of CC-VNs that is used in this thesis. Furthermore it was addressed that co-creation requires CKM and that this involves knowledge exchanges of both tacit and explicit knowledge. The chapter was closed with explaining that several types' of issues can occur related to transferring knowledge. To illustrate these examples of KTIs and possible solutions were given.

The first gap in literature that can be identified is the limited amount of publications that simultaneously consider tacit and explicit issues for knowledge transfer, with exceptions such as Yang & Maxwell (2011). The second gap is the absense of literature that examines KTI in the context of CC-VNs. Hence there is no literature available on possible solutions for KTI in CC-VN. In line with the second research objective of this study, related to BIA, this gap will be filled by examining ICT functionalities that can play a role in solving KTIs in the contect of CC-VNs. This also fills a gap, because the notion of BIA in literature has focussed on interal perspectives of single firm, which falls short with respect to environments such as CC-VNs (Bagheri, Kusters, & Trienekens, 2015).

3 Methodology

This chapter covers the methodology that was used in this study; it will give detailed descriptions of the methodology used in combination with design choices. At the start of each section, related research objectives, questions and outputs are stated. The methodologies are presented in the order in which they were applied.

In this chapter the concepts validity and reliability, which are related to the quality of the research design, are also assessed. Validity can be divided into three aspects: *construct validity*, *internal validity* and *external validity*. Construct validity refers to the identification of "correct operational measures for the concepts being studied" (Yin, 2014). Internal validity refers to establishing casual relationships whereby certain conditions are believed to lead to other conditions, as distinguished from spurious relationships. External validity refers to defining the domain to which the findings of the study can be generalized. Reliability refers to the repeatability of the study. Should the study be repeated by another researcher, the findings and conclusions should be the same (Yin, 2014).

Internal validity mainly concerns explanatory case studies (Yin, 2014). Because this study is mainly exploratory, internal validity will not be covered in every section. Similarly for external validity, since it concerns the finding of a study it is not covered in this chapter but in Chapter 5.

3.1 Structured literature review

As a starting point for completing stage one of the first research objective (developing the KTI classification framework) a SLR was done. This approach was chosen over a grounded theory approach, because CC-VNs are an emerging field and practitioners with real experience are difficult to find. It could have caused the opinions of practitioners to have more influence than their real experiences. This section describes the methodology that was used to answer the following related research question:

> **Q 1.0**: Which KTIs are mentioned in related literate?

As a starting point for the identification of KTI, a systematic literature review (SLR) was done to identify current literature on KTIs. Because there is no literature available on KTIs in a CC-VN context the SLR is conducted in the related field of business networking. The goal was to create a well-structured theoretical foundation to explore and solve KTI in CC-VN contexts. A SLR was preferred over a narrative review as these can be biased by the researcher and often lack thoroughness and rigor (Tranfield, Deyner, & Smart, 2003). The systematic review followed the guidelines of Kitchenham & Charters (2007), which consists out of three stages: Planning the review, conducting the review and reporting the review (Kitchenham & Charters, 2007).

In the *planning the review* stage a review protocol was designed: The search space consists out of a number or databases: The Emerald, Elsevier, Wiley, IEEE, and Springer, these are selected because they cover many publications in the field of interest and are often used in similar studies (Haug, Stentoft Arlbjørn, Zacharissan, & Schlichter, 2013). A set of keywords, combined with Boolean operators, was defined, see Table 2. The databases were searched simultaneously using Google Scholar (GS), because doing the search separately in all databases, with 256 search queries, would have been too time consuming. Repeated evaluations of GS have shown it is capable of delivering results equivalent to those of traditional computerized bibliographic methods (DeGraff, DeGraff, & Romesburg, 2013). A stopping criterion was introduced to cope with the large amount of sources GS delivers: When five pages after the first twenty do not contain any keywords the search is stopped, otherwise the next five pages were included in the search.

Explicit Knowledge	And	Transfer	And	Issue	And	Supply chain
Or		Or		Or		Or
Tacit knowledge		Exchange		Challenge		Collaborative network
Or		Or		Or		Or
Data		Sharing		Barrier		Alliance
Or		Or		Or		Or
Information		Flow		Problem		Inter-organization

Table 2 Keywords combined with Boolean operators

In the *conducting the* review stage, inclusion and exclusion criteria were used to select sources for a full review and data extraction. The article had to focus on both KTIs and one kind of business networking and it had to be published between 2000 and 2015, in English language, and be peer-reviewed. Articles in which KTIs are only a subtopic or in which KTIs are examined from a single firm perspective, were excluded.

3.1.1   Validity
Construct validity
Construct validity was achieved through defining a comprehensive set of keywords and Boolean operators and through including several relevant sources in the search space, guaranteeing that the concept is completely covered.

3.1.2   Reliability
If a later research would repeat the SLR it is expected that very similar findings are found. First, due to the combination of the clearly defined search space and keywords in combination with Boolean operators. Second, the stopping criterion clearly defined how long the search has to continue.

To increase the reliability, data extraction was done independently by two researchers, as is suggested by Kitchenham and Charters (2007). Data, in the form of KTIs was written on cards. These cards included: A title of the KTI, the source (publication information) and, if available, a description of the issue.

3.2   Knowledge transfer issue classification (using the Metaplan method)
To complete stage one of the first research objective (developing the KTI classification framework), synthesis was done on the data regarding KTIs collected during the SLR. For this step a classification method had to be selected and applied. This section describes the methodology that was used to answer the following related research question and produce the following related research output:

> **RQ 1.1**: What is a suitable and feasible method for classifying KTIs from existing literature?

> **Research output 1**: KTI classification framework

3.2.1   Selection of the classification method
To allow for a comparison of classification methods, a list of criteria had been composed in consultation with the research group. The method:
- Has to be suitable for classifying issues into non-predetermined categories with other similar issues.
- Has to be suitable for classifying a set of several hundred unclassified issues.[2]
- Does not have to rank the issues. (I.e. most- common, impact, frequent etc.).

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[2]A quick scan of the literature found by the SLR showed that there would be several hundred issues, rather than tens or thousands.

- Has to be executable with the resources available.
- Has to be time efficient.
- Has to eliminate bias.
- Has to be valid.
- Has to be reliable.

As a result from this, the Metaplan method was selected to classify the KTIs into categories, because the Metaplan method scored best on all criteria. Appendix A describes the process of and justification for the selection of the Metaplan method in more detail. The search for more alternative classification methods was stopped because the Metaplan method was suitable and feasible. Due to the time required to find more alternatives, it was unlikely that, even if a better method is found, the benefits of this method could justify the effort it took to find the method.

3.2.2   The Metaplan method

The Metaplan method applies structured meetings to classify KTIs."Metaplan was developed in the early 1970s by several researchers (Cloyd, et. al., 1975) as an answer to the problem of poor meetings" (Howard M. S., 1994). Conducting a metaplan session requires some basic office supplies and a minimum of four people (Habershon, 1993). During the sessions cards were used with KTIs written on them. "Clusters are formed by group members grouping similar concepts together. For the first few cards, there are no clusters; the cards stand alone comprising their own cluster. Then, as more and more cards are sorted, clusters start to form" (Howard M. S., 1994). Trough multiple Metaplan sessions the KTI classification framework was developed, a more elaborate description of this process is given in Appendix B.

3.2.2.1   *Strengths*

Compared to the other methods that have been considered (stated in Appendix A) the Metaplan method was the most time efficient. Because Metaplan sessions are group meetings the participants can easily verify if all participants have the same interpretation of an issue, this would be a lot harder when applying different methods in which the results of individual work are combined.

3.2.2.2   *Weaknesses*

One of the possible biases of the Metaplan method is *the bandwagon effect*. The bandwagon effect can occur when someone adjusts their own opinion to that of the majority of the group or a dominant personality within the group (Paul, 2008) (Geist, 2010). This effect is mitigated by keeping an open atmosphere during Metaplan sessions, where people are not judged or ridiculed for having a different opinion.

3.2.3   Validity

Construct validity

Through first looking at which methods are available for classifying KTI and scoring them on predefined criteria, it is ensured that no obvious better alternatives to the Metaplan method are overlooked. The Metaplan method is a suitable method for classifying KTIs. The members of the research group were all familiar with the context of the study and the KTIs that had to be classified. This allowed them to discuss well-reasoned arguments for why a KTI should be placed in a particular cluster, once consensus is reached a KTI was placed in a particular cluster. This means that the resulting collection of clusters and the issues that each cluster contains are well-reasoned.

The input for the Metaplan sessions was collected through a SLR. Through this processes it is ensured that the correct material is used during the Metaplan sessions.

Internal validity

To increase internal validity, the weaknesses of the Metaplan method were addressed. The open atmosphere during the sessions allowed everyone to share their thoughts freely, preventing *the bandwagon effect*.

3.2.4   Reliability

Repeating the sorting with participants that have similar backgrounds is expected to yield very similar results. For classification methods in general, the difference that is likely to occur is a difference the abstraction level chosen by the participants. Some clusters could be divided into more specific clusters, other clusters could possibly be merged. The reliability can be improved by introducing multiple layers of abstraction.

In this study the reliability was improved through the introduction of an additional (higher) level of abstraction. A lower level was not introduced because the framework still had to be validated in practice. Increasing the amount of clusters would have made the validation a lot more difficult and time consuming.

3.3   Validating the KTI classification framework through a multiple case study

The second stage of the first objective (validation of the KTI classification framework) was completed by conducting a multiple case study. In which the data was collected through semi-structured interviews. This section describes the methodology that was used to answer the following related research questions and produce the following related research output:

> **RQ 2.0**: Which KTIs occur in CC-VNs (validation of the KTI classification framework)?

> **RQ 2.1**: Which KTIs are considered most important by practitioners?

> **Research output 2:** Validated, enriched KTI framework

3.3.1   Multiple case study

The SLR was used to collect data about known KTIs. Using the Metaplan method this data was used to develop a KTI classification framework. There was a gap in literature about KTIs in the context of CC-VNs. This meant that the existence of these KTIs in the context of CC-VNs still had to be validated; this was primary goal at this stage is. The secondary goal was determining which KTIs are important to practitioners and should be taken to the next phase of this study: the exploring of ICT solution types. For both goals data had to be collected from practice. There were three options available for doing this: (I) getting data from people who have experience from several CC-VNs, (II) a single case study and (III) a multiple case study.

The first option was not used for two reasons: Because for the second research objective, participants should be focused a one single CC-VN. The second reason was that it was unlikely that enough participants could be found for that option. The second (single case) option was undesirable because the KTI classification framework would be validated using the principles of saturation. Furthermore a single case study is often done for a critical, unique or extreme case (Saunders, Lewis, & Thornhill, 2007); which was not available. Hence the third option was selected: a multiple case study. This made it possible to validate the KTI classification framework using the principles of saturation, while having participants that were focused on a single CC-VN for the second research objective. The CC-VNs were treated holistically because we were only interested in treating the CC-VNs as a whole. Dividing the CC-VN in sub-units (such as the focal firm and one specific partner or customer) was undesirable as that would remove the network context.

3.3.2 Data collection method

Data collection was done through conducting semi-structured interviews with practitioners. Other methods had been considered but had certain disadvantages:

- Collecting data from *documentation* has the advantage that it can be reviewed repeatedly and is not created as a result of the data collection process (Yin, 2014). However, it might be difficult get permission from practitioners to gain access to documents. Additionally, if access is given, it is hard to verify that access to all relevant documents is given. Another issue is that some issues that practitioners are experiencing might never be documented (such as, for example, a poor relation with a partner).

- Collecting data through *direct observations* has the advantage that it reveals issues that the practitioners are currently experiencing (Yin, 2014). This advantage however, is also the drawback of this method. It will not reveal issues that practitioners experienced in the past.

- Collecting data through *written surveys and questionnaires* has the advantage that more cases can be studied because, for the researcher, the method is time efficient (Yin, 2014). A disadvantage is that respondents might not provide as much data as they would do during an interview, because respondents have to answer rather closed ended questions. Open ended would be very time-consuming for respondents to write down questions (could you please write down all CKM issues that you ever experienced?). Another disadvantage is that it is uncertain who answers the questions (did a practitioner pass the survey on to a secretary?).

Interviews can corroborate certain findings (Yin, 2014). Implying that the method is suitable for the verifying the existence of KTI in the context of CC-VNs. Next to other data collection methods having disadvantages, interviewing offers the following advantages:

- Interviews are suitable for when there is a large number of questions to be answered (Healey, 1991). Based on the type of data that has to be obtained, the other methods would be inappropriate to answer (verify) all questions (issues). Asking participants to write down examples of issues will most likely reduce the amount of issues that are disclosed and the amount of details in descriptions.

- An interview also allows control over who answers the questions and it allows the interviewer to clarify any ambiguous or complex questions (Healey, 1991) (Saunders, Lewis, & Thornhill, 2007). This overcomes the weaknesses of using surveys and documentation as data sources.

- A more elaborate explanation from the interviewee can be asked when answers are too brief or inconsistent with previously given answers (Healey, 1991). A type of interaction with the data source that other data collection methods do not allow.

- Face-to-face interviews usually achieve a higher response rate than questionnaires (Healey, 1991). This is an advantage over all other data collection methods.

According to Qu (2011) decisions that must be carefully considered when choosing an interview approach are:

I. what type of interview to conduct,
II. who to interview,
III. how many interviewees are required and
IV. how the interview data will be analyzed.

I, II and III are discussed first in the remainder of this chapter, followed by weaknesses of interviews and remedies, ethical issues, a rationale for the protocol used for the interviews and the chapter closes with IV.

3.3.2.1   Semi-structured interviews

The interviews that were conducted were *semi-structured*. A semi-structured interview involves questions that are prepared beforehand, the interviewer has to ensure that all questions are covered while using probes to elicit more elaborate responses (Myers & Newman, 2007) (Qu & Dumay, 2011). Other types of interviews are less suitable for the purpose of verifying a pre-specified list of issues.

Unstructured interviews could facilitate the building of theories (e.g. grounded theory), but this was not the goal of the interviews. The lack of structure could have caused some KTIs to not be covered during the interview. An unstructured interview is most suitable for exploring KTIs that were previously unknown, even though it is unlikely that these will be discovered, they should be explored. However, this is not a problem when conducting semi-structured interviews, because these can also be exploratory (Saunders, Lewis, & Thornhill, 2007).

Structured interviews were also not preferred because there is no room for improvisation (Myers & Newman, 2007). The interviewer has to be able to react to the statements of the interviewee. A Semi-structured interview is flexible (Qu & Dumay, 2011). If the interviewee does not elaborate, on what could be a rich vein of data, the interviewer has the freedom to probe the interviewee; or change the order in which questions are asked (Saunders, Lewis, & Thornhill, 2007). Additionally, "It enables interviewees to provide responses in their own terms and in the way that they think and use language" (Qu & Dumay, 2011).

3.3.2.2   CC-VN and expert selection criteria

The quality of the data that is obtained through interviewing strongly depends on the interviewee, therefore only 'experts' in the field were interviewed. An expert for this study can be described as someone who: works in a CC-VN with knowledge transfer processes and is capable of giving answers of a high abstraction level, so that the findings are not only applicable to the organization of the expert.

To find these experts, first CC-VNs were identified. In practical terms this meant finding organizations, which had a partner, that communicate with their customer(s). This situation is also depicted in Figure 4. After determining an organization operates in a CC-VN the organization was approached for participation in this study. To strengthen the claim that the selected organization operate in a CC-VN environment and not a supply chain environment the CC-VNs were mapped to on the SODSC framework (Rasouli, Kusters, Trienekens, & Grefen, 2014). The process of this mapping is explained in more detail in Appendix C. To facilitate determining who is an expert within these CC-VNs, a set selection criteria was composed in consultation with the research group:

- *An expert works or has worked in the CC-VN for at least two years.*

This thesis is aimed at discovering which KTIs occur in CC-VNs, the approach selected for this was doing a multiple case study. For this study the expert was required to have two years of experience (in the context of a CC-VN, working with knowledge transfer processes). Although more years of experience make it more likely that someone has come into contact with KTIs, it does not have to be so. It was also taken into consideration that, with CC-VNs being a relatively new phenomenon, increasing the amount of years of experience required would have made it very difficult to find enough participants for this study.

- *The expert had to be directly involved with* knowledge transfer *processes.*

Only when a person is directly involved with knowledge transfer processes he can have personal experiences with KTIs.

- *An expert is recommended by someone who works in the same organization.*

The rationale behind this criterion was that: people who work in an organization know who would be the most suitable candidate within their organization for participating in this study. For example, a director

might not be the best choice for several reasons: they might delegate knowledge transfer related tasks (or issues) to someone else. Or perhaps there is a college who is equally qualified to participate, that has a lot more time available to participate, making the data collection process less rushed. To clarify, someone could also recommend himself.

However, through this criterion, the person that makes the recommendation (i.e. recommender) can have a lot of influence on the data that is collected. Therefore the recommender had to meet the following criteria:

> o *The recommender must have enjoyed higher education.*

The purpose of this criterion was to make it safe to assume that the recommender understands the research objectives and is capable of objectively assessing who is most suitable to participate in this study.

> o *The recommender works in the same organization as the expert.*

The purpose of the recommendation was: to have someone that knows an organization (i.e. the context) pointing out the most suitable candidate. As people that work in an organization are assumed to be more knowledgeable about 'who is the most suitable expert' in their organization than someone that does not work in that organization.

3.3.2.3   Number of interviews

For determining the amount of interviews that had to be conducted to verify the KTIs, the principles of data saturation were used. This means that additional interviews were conducted until no new additional data was found (Francis, et al., 2010). Using data saturation as a method to determine the amount of interviews that have to be conducted requires an *initial sample size* and a *stopping criterion* to be defined before conducting interviews (Francis, et al., 2010).

Initial sample size

The *initial sample size* was set to two interviews. Because: the experts that were going to be interviewed were quite similar in the sense that they all operate in a CC-VN context (due to the expert selection criteria). Meaning that there was a chance that they all experienced the same KTIs. Furthermore if one expert was able to verify all KTIs the main purpose of the conducting the interviews would be fulfilled, which is verifying if the found KTIs occur in practice. The secondary purpose of conducting the interviews was determining which issues are important to practitioners and should be considered for the next phase: finding ICT solution types. A smaller initial sample size would have made the person being interviewed too influential on the next phase of this study. A larger sample size might have caused time constraints and caused unnecessary interviews to be conducted. The latter could also be considered unethical because resources are wasted as well as the time of participants.

Stopping criterion

The *stopping criterion* was set to two (i.e. two more interviews will be conducted without new data emerging) this number was linked to the nature of the analysis, the complexity of the research questions and diversity of the sample (Francis, et al., 2010). The goal was the verification of an existing list. Reducing the stopping criterion could have led to premature discontinuation because coincidently no new data emerged during an interview. Increasing the stopping criterion was undesirable for reasons similar to those for not increasing the initial sample size.

3.3.2.4   Weaknesses of interviews and remedies

In this section weaknesses of interviews and remedies/actions taken, are discussed. There are several weaknesses of interviews mentioned in research methodology literature, Yin (2014) states that weaknesses

include: (I) response bias, (II) poorly articulated questions, (III) poor recall and (IV) the ineterviewee might just say what the interviewer wants to hear.

(I)   Interviewee response bias, "Interviewees may [...] not to reveal and discuss an aspect of the topic that you wish to explore, because this would lead to probing questions that would intrude on sensitive information that they do not wish, or are not empowered, to discuss with you" (Saunders, Lewis, & Thornhill, 2007).

To prevent this issue from having impact on this study, anonymity was ensured towards the interviewees. The data that was collected is presented in such a way that it cannot link back to the interviewee. Additionally the interviewer had no stakes in the organization, meaning the interviewee had no reason to feel threatened by the interviewer.

(II)   Poorly articulated questions.

To prevent language becoming an issue interviews were only conducted in Dutch, the native languages of the interviewer and all interviewees. Furthermore a pilot interview was conducted.

(III) Poor recall.

To limit the effects of this issue the interview did not start directly with asking questions. First the interviewee was introduced to the topic of interest of the interviewer, giving the interviewee time to reflect upon KTIs that they have experienced. Additionally the interviewee was asked to make a drawing of his network, to trigger his memory.

(IV) The interviewee might just say what the interviewer wants to hear.

Similar to (I) the interviewer had no stakes in the organizations, meaning the interviewee had no reason to feel threatened by the interviewer and was able to give honest responses. The interviewer was also aware of the existence of this issue and has been careful not to show approval or disapproval on statements of the interviewees.

Furthermore the results of an interview originate from the interpretation of the interviewer and can never be an exact mirror of reality (Qu & Dumay, 2011). This was an issue that could only be recognized rather than solved. However, this issue would have also been present if another form of data collection would have been used. Although the issue cannot be solved, the impact of it can be made transparent. Tong, Sainsbury and Craig, (2007), and Graneheim and Lundman (2004) state that a description of the interviewer should be given. Additionally Tong, Sainsbury, & Craig, (2007) state that the relationship between the interviewer and the interviewee should be described as it can effect the responsens of interviewees and the understanding of the interviewer. For these reasons a description of the interviewer and his relation to the interviewees is stated in Appendix C.

3.3.3   Ethical issues

Qu and Dumay (2011) mention ethical issues which have been taken into account. These issues and the actions taken are shown in Table 3.

Ethical issue	Actions taken
Impose no harm	Only individuals that voluntarily give consent to participate have been interviewed. In addition all participants were informed that they had the right to stop participating and they had the right to refuse to answer any particular question. Additionally, recordings of interviews will be destroyed after completion of this study.

Relationship-based ethics	"there may exist a power differential between the interviewer and the interviewee because of their relative social status […]. The interviewer must manage the power differential judiciously so as to not exploit it for personal gain or to unduly influence the responses of the interviewee." (Q. Qu 2011) Being aware of a potential power differential issues allowed the interviewer avoid creating a situation where this could occur.
Disclosure of research intent	The cause, goal and structure of the research were explained.
Right to privacy and confidentiality	The identities of participants have concealed in published results and collected data was kept securely and confidentially within the research group.

Table 3 Ethical issues

3.3.4 Interview protocol design

All the interviews that were conducted were semi-structured. To provide this structure an interview protocol was developed. This section discusses the rationale on which the interview protocol was based and designed. The interview protocol itself is presented in Appendix D.

Every interview started with explaining the purpose and structure of the study and the interview. To support this introduction a visual aid was used that depicts the outline of the study and the role that the expert has in the study. Using a visual aid serves multiple purposes: it enhances the understanding of the audience, additionally a better preparation makes the interviewer come across more professional and it focuses the attention of the audience (Saunders, Lewis, & Thornhill, 2007).

After the introduction, but before the first questions were asked, the interviewee was asked to draw the CC-VN that his organization operates in on a piece of paper. This activity served multiple purposes:

- Through the drawing the context was made explicit and included, hence the interviews could be treated as case studies rather than expert interviews,
- Establishing rapport with the interviewee,
- Triggering the interviewee's memory,
- The interviewer got a better understanding of the interviewee's CC-VN,
- It allowed the horizon of the network to be determined. Which also aided in the mapping of the CC-VN on the SODSC framework and
- The drawing functioned as a visual aid during the interview. The visual aid helped the interviewer to keep the attention of the interviewee focused on the CC-VN. It also assisted the interviewee in explaining the interviewer certain inter-organizational KTIs.

Before the questions were asked the interviewer emphasized to the interviewee that: he is interested in hearing about actual issues that the interviewee has experienced (in his CC-VN), not in opinions of the interviewee. The first questions that were asked were very open. This allowed the interviewer to get a feeling for how the interviewee is involved with knowledge transfer processes, the language the interviewee uses and which KTIs the interviewee finds important. Furthermore these open questions allowed room for the interviewee to mention KTIs that were not yet included in the KTI classification framework (enrichment).

After the open questions, the questions were based on the KTI classification framework. The interviewer went through the list of all identified KTIs and asked if the interviewee had ever experienced a particular KTI. Asking the interviewee directly if he has experienced a particular KTI could be considered leading the interviewee, but since the interviewee was asked to give a real example and not an opinion this is not an issue. However, for every example given, the interviewer had to be sure that the example was: real and happened in the correct context. Additionally for every good example the interviewee was asked follow

up questions: If the issue still occurs, if he thinks it is an important issue and why he thinks that. This was to determine if the issue should be considered for solution finding in the two round Delphi study. The open ended questions required the participant to justify why he thought something was or was not important. Additionally it allows him to provide further clarification of his example. Using Likert scales for this had been considered, but they were not used as these might have drawn attention away from an answer to the '*why*' question regarding importance.

If the available time during the interview allowed it the interviewee was also asked how important he thought the KTI were that he did not come into contact with himself.

After the interviewee was asked about the KTIs in the KTI classification framework, he was asked if he could think of any KTI that he has experienced that was not covered during the interview. Although guaranteeing the completeness of the KTI classification framework was not main the goal of the interviews, it was done to enrich the KTI classification framework. This increases the quality of the study results through ensuring that no obvious issues have been overlooked.

The interview ended with some general questions about the interviewee and his organization. The answers of these questions (such as questions regarding completed educations) could often be found on networking sites. Answering these questions up front and asking the interviewee to verify these answers showed that the interviewer put effort in preparing the interview and made him come across more professional.

3.3.5   Data analysis
This section covers how the interviews were analyzed.

3.3.5.1   *Deductive Content analysis*
Content analysis (CA) refers to the systematically organizing of data into a structured format (Tong, Sainsbury, & Craig, 2007). The interviews will be analyzed by employing a form of CA called: deductive content analysis (DCA). Since DCA is suitable for situations where the structure of analysis is operationalized on the basis of previous knowledge and the purpose of the study is theory testing (Elo & Kyngäs, 2008). The unit of analysis (the object that is studied) was: the whole interview, as is recommended by Graneheim & Lundman (2004). The unit of meaning that was used is: an example of a KTI, this can vary between one and several sentences. The KTI classification framework that resulted from the Metaplan sessions was used as the bases of a categorization matrix, see Table 5, to which condensed units of meaning were coded for correspondence with or illustration of a category (Elo & Kyngäs, 2008).

The examples of the participants were divided in 3 categories:

1: *Strong examples*: real concrete examples in the context of CC-VNs
2: *Weak examples*: A general description of occurrences of a KTI without a concrete/elaborated example.[3]
3: *Internal examples*: real examples that occurred in the wrong context (within the organization of the interviewee rather than in the CC-VN of the interviewee)

For each example that an interviewee gave he also states if he thought the KTI was important and why he thought that. Based on his explanation an 'importance rating' was associated with the example, ranging from 1 to 3. Where 1 means the KTI was not considered important, 2 means the issue was not important but also not unimportant and 3 means that the issue was important. In cases where a participant gave multiple examples of a KTI the highest importance rating was kept. The rationale for this is that more actual occurrences of a KTI do not make the most important example less important.

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[3] A weak example makes it difficult to establish with certainty that the example of the KTI: 1) really happened, 2) happened in the right context.

3.3.6 Validity

Construct validity

Construct validity was assured through several actions and activities. First of all, validity is ensured though strict criteria for selection participants (Graneheim & Lundman, 2004). Second, the interview protocol was based on the KTI classification framework. Assuring the concept that was being studied was covered completely. The protocol was evaluated by the research group and a pilot interview was conducted to test the protocol, which was also evaluated by the research group. Furthermore the principles of data saturation that have been used ensure that the results are not influenced by stopping the data collection prematurely.

The CC-VNs were mapped on the SODSC framework, to ensure that the cases that were selected matched the 'CC-VN criteria' and were not supply chain. This ensures that the data is collected from appropriate sources.

All interviewees were sent an interview report, allowing them to verify that their statements had been interpreted correctly. This is a form of triangulation which has the added advantage that it can be a source of new interpretations that have not occurred to the researcher before (Saunders, Lewis, & Thornhill, 2007).

Internal validity

To increase the validity of the obtained data, the interviews were recorded (with explicit permission of the interviewees). After the interview an interview-report was made. Due to the amount of interviews that had to be conducted in this study, the interviews have not been transcribed verbatim as transcribing one hour of recorded interview takes around seven hours (Jankowicz, 2005). However, all relevant parts of the interview were still translated and written down in an interview report. To ensure that the participants' perspectives and meanings were correctly interpreted, participants were given all given an opportunity to review the interview-report and provide feedback (Tong, Sainsbury, & Craig, 2007) (Merriam, 2009).

3.3.7 Reliability

To facilitate reliability, a clear description is given of: the context of this study, the selection criteria for participants, the data collection process and the process of analysis (Graneheim & Lundman, 2004) (Elo & Kyngäs, 2008).

The principles of saturation have been applied in this study to validate a list of KTI. Through the use of this list of KTI structure was introduced to the interviews. Participants were asked for each KTI is they have ever experienced it, meaning that if they had such an experience they were likely to mention this experience. This is a lot more reliable than applying unstructured interviews (grounded theory). Where the list of KTI would be build based on the statements of interviewees. The interviewee would have to mention KTIs without being triggered, this is a lot harder for the participant than sharing experiences regarding a specific KTI.

To eliminate individual bias, the codifying/ labeling process was always done independently by the author and another member of the research group. The results of the independent labeling were compared in meetings, of approximately one hour, in which differences were discussed and resolved. In rare cases where they could not agree on the label of an example, the example was discussed with the entire research group until agreement was reached.

Furthermore with regards to the reliability of interviews, someone else repeating a particular interview will almost certainly obtain different results. Because "human behaviour is never static" (Merriam, 2009). "Different interviewers will evoke different responses from the same interviewee given the way questions

are asked and probed" (Qu & Dumay, 2011). Additionally, if a person is interviewed for a second time, the fact that he has already heard the questions before can influence his responses. However, this has to be put in perspective. A different person conducting the semi-structured interviews would collect very similar data, although the exact statements might be different, the main message would still be similar. Merriam (2009) also states that not being able to exactly replicate a qualitative study does not discredit the results. It is more important that, given the data collected, the results make sense, opposed to an outsider being able to get the same results.

3.4   Comparing the proposed KTI Framework to other related frameworks

The first objective of this thesis is the development and validation of a KTI framework. Assessing the value of the KTI framework was done through comparing it with related frameworks. This way it could be made clear how the KTI framework adds to existing literature. This section describes the methodology that was used to answer the following related research question:

> **RQ 2.2**: How does the KTI framework compare to related frameworks?

The frameworks that the KTI framework is compared to are a result from the SLR and have been used (in combination with other sources) as input for the Metaplan sessions. The related frameworks were independently selected by the author and another member of the research group, from the publications that were included in the SLR. A set of six aspects has been defined in consultation with the research group, which was covered in each comparison.

(I) Development methodology: How, through what kind of process has the framework been build?
(II) Validation: Has the framework been validated in practice? If so, how has that been done?
(III) *The number of mentioned KTIs in the related framework*
(IV) *The number of KTI framework KTIs mentioned[4]:* How many of the KTIs from the KTI framework are mentioned in the related framework? (III) and (IV) give insights into how the scope and abstraction levels of other frameworks compare to the KTI framework.
(V) Limitations: This is discussed to illustrate the limitations of other frameworks compared to the KTI framework.
(VI) Missing KTIs: Based on the comparison of (III) and (IV) KTIs that are missing in related frameworks are identified.

For each framework comparison a short discussion was included, to provide a short clarification and explanation for why the related framework differs from the KTI framework.

3.4.1   Validity

Construct validity
Through selecting the related frameworks form the publications that were included during the SLR it is made certain that the correct material is included for the comparisons.

3.4.2   Reliability

Should a later researcher repeat the comparison he is likely to achieve very similar results. Because the aspects on which a comparison are done are well defined. Furthermore the search space for related

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[4]*For every related framework the KTIs are placed into the KTI framework one by one. Since these KTI have often been used as input for the KTI framework, the results of the Metaplan sessions (Appendix B) could be used to place the KTI from the related framework into the KTI framework. When this is not the case the KTI was determined by the author. When the placing of a KTI from a related framework it was not obvious it was discussed with another member of the research group.*

frameworks is well defined; it consists out of the 54 publications selected during the SLR. Because this search space is relatively small an exhaustive search can be done.

Reliability is also improved through using the results of the Metaplan session to place KTIs from related frameworks into the KTI framework. This activity limits the influence the researcher can exert on the results, hence reducing the effects of individual bias. Through the inclusion of other research group members for non-obvious cases the effects of individual bias is further decreased, increasing the reliability.

3.5   First research objective conclusions

Through the methodology described thus far in this chapter it was possible to achieve the *first research objective* (the development and validation of a KTI framework for CC-VN contexts). RQ 1.0, RQ1.1 and *research output 1* provided a foundation based on existing literature on KTIs, the KTI classification framework. The KTI classification framework was used as a tool to conduct semi-structured interview in a multiple case study. Through this multiples case study RQ 2.0 and RQ2.1 could be answered and *research output 2* was produced, the KTI framework. Through RQ2.2 (comparing the KTI framework to related frameworks) it was possible to determine what the KTI framework adds to existing literature.

Because there is no existing literature available on KTIs in CC-VNs, the *first research objective* had to be completed before it was possible to achieve the *second research objective*. This is because the *second research objective* requires a list of relevant KTIs as input.

External validity
External validity concerns the degree to which a study's findings are generalizable beyond the immediate study (Yin, 2014). In this study multiple cases have been studied. All of the cases that have been studied were subjected to selection criteria. Through this selection criteria a cases (CC-VNs) were selected. These cases are homogeneous in the sense that they are all CC-VNs but they are heterogeneous is the sense that not of the cases are the same. The CC-VNs occupy different positions in the SODSC framework and all have different CC-VN compositions. Because not just one specific type of CC-VN was studied, but multiple, the findings can be generalized to CC-VNs. This multiple case study was conducted in the Netherlands, meaning that the results might be influenced by the culture of the Netherlands and hence, make the results more applicable to Dutch CC-VNs. There are models available which characterize countries and their respective cultures (Hofstede, Hofstede, & Minkov, 2014).

3.6   Finding solution types using a two round Delphi method

To achieve the second research objective, solutions in the form of ICT functionalities were discovered in CC-VNs, for the most relevant KTIs, using a two round Delphi method. Allowing this thesis to function as an example case where the approach is tested. This section describes the methodology that was used to answer the following related research questions and produce the following related research output:

RQ 3.0: What types of ICT functionalities can help to solve the most relevant KTI in CC-VN contexts?

Research output 3: A collection of ICT functionality types

RQ 4.0: Has the process used in this study been effective?

Only the ten most relevant KTIs are selected for the Delphi study. The relevancy of these KTIs was determined during the KTI classification framework validation. Including all 29 KTIs was not feasible or desirable, due to the time it would have required and the load it would have put on the participants. With the ten most relevant KTIs it was still possible to achieve the second research objective. The process could

be tested and assessed. However, since not all 29 KTIs are included in the Delphi study, it is unlikely that the resulting list of ICT functionalities is complete.

3.6.1 The Delphi method

The Delphi method is an iterative process where judgments of experts are collected through a number of questioning rounds interspersed with feedback (Skulmoski, Hartman, & Krahn, 2007). It is a flexible method for structuring a group communication process to facilitate group problem solving (Skulmoski, Hartman, & Krahn, 2007) (Okoli & Pawlowski, 2004). The Delphi method eliminates undesirable psychological effects that can occur in group sessions (Ono & Wedemeyer, 1994) (Landeta, 2006).

A 'Classical Delphi' has four characteristics (Skulmoski, Hartman, & Krahn, 2007):

1. Participants are anonymous to each other (Rowe & Wright, 1999)
2. Controlled feedback is given to participants from other participants (Rowe & Wright, 1999)
3. Iteration (Rowe & Wright, 1999)
4. Statistical aggregation of group response (Rowe & Wright, 1999)

The anonymity characteristic was included in this study. Because anonymity between the participants is an important aspect of the method (Rowe & Wright, 1999) (Okoli & Pawlowski, 2004) (Landeta, 2006) (Ferri, et al., 2006) (Skulmoski, Hartman, & Krahn, 2007) (Paul, 2008) (Geist, 2010). This allows opinions to be expressed free from peer-group pressure (Ferri, et al., 2006) and participants can change their minds without feeling judged by others in the group (Geist, 2010). Anonymity undoes social pressures from dominant or dogmatic individuals or from a majority (Rowe & Wright, 1999). This allowed the participants to consider each idea on the basis of merit alone (Rowe & Wright, 1999).

Iteration & feedback: the first round of a Delphi study is a generative round where participants generate ideas and comments about the issues (Geist, 2010). In the rounds after that the participants can refine their views in light of the feedback from the group (Skulmoski, Hartman, & Krahn, 2007). The repetition also facilitates more extensive consideration (Landeta, 2006).

Based on the aforementioned characteristics a two protocols were designed, see Appendix G. Later in this chapter a rationale is given for the design choices that were made for these protocols.

3.6.2 Expert (participant) selection

Many publications about the Delphi method address the importance of selecting the right experts for participation (Rowe & Wright, 1999) (Okoli & Pawlowski, 2004) (Landeta, 2006). For this study the experts that participated in the KTI classification framework validation interviews also participated in the Delphi study. This had the advantage that it was already established that these peoples' organizations operate in CC-VNs. Their participation to the KTI classification framework validation also ensured that they were familiar with the matter that is being discussed and the goals of the study.

3.6.3 Two rounds

According to Skulmoski, Hartman & Krahn (2007) the method can be modified to fit the needs of a particular study. The main goal that had to be achieved with the Delphi method in this study is: testing the process of coming up with ICT solution types for specific KTIs. The way the method was used in this study is not typical in the sense that it did not support a decision making process or to forecast future events. The method was used as a brainstorming tool, to find ICT functionalities to the most relevant KTIs.

Typically the first round of a Delphi study is used to establish a long list of ideas, in the second round this list is turned into a short list and in the rounds after that the ideas are ranked. This ranking is usually done to support decision making processes. This research objective is not aimed at supporting a decision

making process. Therefore ranking is not strictly necessary. Furthermore due to the heterogeneity of the eight different CC-VNs, it was unlikely that the answers of the participants would converge. Therefore the choice was made to do a two round Delphi rather than a three or four round Delphi. During the second Delphi round participants were asked to validate that, their inputs had been correctly interpreted and provide additional input after possibly being triggered by the ideas from other participants. This meant the list of suggest ICT functionalities diverged in the second round rather than converged. Although ranking was not the objective, it was examined which suggested functionalities are considered *useful* or *important* by the participants.

3.6.4   Weaknesses of the Delphi method and remedies

Although the Delphi method has numerous advantages the method also has weaknesses. Fatigue can occur when there are a large number of topics or questions per Delphi topic (Geist, 2010). This is one of the reasons that a selection was made of the ten most relevant KTIs rather than discussing all KTIs. Additionally for each KTI the same questions were asked. This also allowed the interviews to be conducted within an hour, as was promised to the participants at the beginning of the study.

Deficient application of the method can also be an issue (Landeta, 2006). This involves several aspects, such as: 'lack of explanation to participants'. During the introduction of the KTI classification framework validation interviews the participants were explained how the Delphi method works. They were explained another time at the start of each Delphi round. Other issues are poorly formulated questions and insufficient result analysis (Landeta, 2006). To prevent poorly formulated questions a pilot interview was done for the first Delphi round. Insufficient result analysis was also prevented through structuring the results through a Metaplan session with the research group.

3.6.5   Delphi protocol design

This section presents the rationales for the Delphi protocol design.

The judgments from experts were obtained through face-to-face interviews. Interviews were preferred over questionnaires via email because experts can be much more elaborate in their responses in a face-to-face interview. Additionally the interviewer could probe the participant and ask for/provide clarifications when needed. The interviews were conducted by the author of this thesis. The interviews have also been recorded with explicit permission from the participants.

At the beginning of every Delphi round the participant was sent a document with the material that was going to be discussed during the interview. This allowed the interviewee to prepare and come up with ideas in advance. There is a risk that the participant misinterprets some of the content has been considered. But, feedback is an important characteristic of the Delphi method, it allows the participants to get become familiar to the structure (receiving a document before the interview). Furthermore, one of the advantages of doing face-to-face interviews is that the interviewer could intervene if such a misinterpretation occurred and provide a clarification.

Both the interviews and the feedback were in Dutch, the native language of the interviewer and participants. The task of 'moderating' was done by the author and another member of the research group. This involves analyzing the results of each round and composing the documents used to give feedback to the participants. For this task the results were translated to English.

3.6.5.1   Round 1

During round one the participant were shown the ten most relevant KTIs (determined through the validation interviews) and were asked separately for each KTI <u>what</u> kind of ICT functionalities can help in

solving the KTI. The question was formulated with '*what*' rather than '*which*' so that the participant was more likely to respond with functionalities and solution types rather than practical solutions.

Every time the participant suggested a functionality he was also asked why he thought that the functionality could help. When a participant thought that there is no solution that involves ICT for a KTI, he was asked if he could think of other solutions. This is because his ideas could still inspire other participants when they obtained it as feedback.

After the interview of round one, the answers of the participants were summarized (using the recording of the interview) and the participants were given a chance to review the summaries via email, before they were shared with the other participants as feedback. The participant was also asked to confirm that he agrees that his statements were all present and correctly interpreted in the summery. The answers were summarized to reduce the load on the other participants when feedback is given.

When the feedback was given to the participants the participants were not be able to identify which answers originated from a particular participant. This was done so that the ideas were judged on merit alone.

3.6.5.2 Round 2

In round two the input from round one was summarized in condensed statements of ICT functionalities with the rationales from the participants that suggested them. Each participant was asked if he recognizes his own input. This is done to improve construct validity.

None of the input from the first round was removed, this was done because, with the exception of one or two suggestions, all of the input was of sufficient quality. The benefits of removing these suggestions would not have been a significant improvement for the protocol of round two. Leaving them in also ensured that every participant could recognize his own input and a discussion with the participant about why his input had been left out was avoided.

The participant were asked to state which of the suggested functionalities are *useful* in the context of his own CC-VN and which of the suggested functionalities are *important* in the context of his own CC-VN. This was done to see if any functionality can be seen as more important than others for solving a particular KTI. The participant was not asked label a predetermined number of functionalities as *useful/important*, because this might cause him to either label more, or less, functionalities as *useful/important* than he thinks are *useful/important*.

After having examined all of the input from other participants for a particular KTI, the participant was asked if the input from others had triggered him to suggest additional functionalities. This was done to increase the completeness of the list of suggested ICT functionalities.

3.6.5.3 Structuring the result using the Metaplan method

For the ten relevant KTIs that were included in the Delphi study the participants suggested a lot of similar ideas, because there are ICT functionalities that can help to solve multiple KTIs. To structure the ICT functionalities mentioned by the participants into functionality types, a Metaplan session was held with the research group. A member could not attend the sessions but provided feedback on the results. The Metaplan method has been elaborately discussed in section 3.2. Through this Metaplan session *research output 3* was produced.

3.6.6 Assessing the effectiveness of the used process (RQ 4.0)

To reach the second research objective RQ4.0 had to be answered. This was done through multiple sources of evidence to strengthen increase construct validity (Yin, 2014). One way to answer RQ4.0 is to analyze *research output 3* and determining if it useful. This however, does not necessarily mean that the

used process was efficient. To determine if the used process in this study was efficient, there participants were asked three general questions about the research process at the end of the second Delphi round. These questions were formulated in consultation with the research group:

1) Do you think that you've gotten a grip on the discussed issues? (why?)
2) Have you experienced your participation to the research as useful? (why?)
3) The seeing of all of the issues and the input from other participants helps you to come up with solutions. (why yes / why not)

The participants were always asked to explain their answer. Attention was paid to formulate the questions in a natural way, so that the participant is not led into giving a positive or negative answer. The answers to these questions were transcribed and translated so that they could be discussed with the research group.

3.6.7 Validity

The Delphi method is a method which is regularly used, "the scientific community has accepted this technique as another research technique, with present-day validity and use" (Landeta, 2006).

Construct validity
Similarly to a normal survey, construct validity can assured through careful protocol design and by pretesting (Okoli & Pawlowski, 2004). Accordingly, in this study the protocols for both rounds were carefully designed and evaluated with the research group. The protocol for the first round was tested in a pilot interview. The second round required participation to the whole study, hence conducting a pilot is not possible. Therefore the protocol was optimized after the first interview.

"In addition to what is required of a survey, the Delphi method can employ further construct validation by asking experts to validate the researcher's interpretation and categorization of the variables. The fact that Delphi is not anonymous (to the researcher) permits this validation step, unlike many surveys" (Okoli & Pawlowski, 2004). Accordingly, after the first round the participants were send a summary of their input. This was done in the following form: for each KTI, the ICT functionalities mentioned by the participant and the provided rationale. Additionally during the second round participants were asked if they could recognize their own input.

The two round Delphi study functioned as a test case through which the second research could be achieved objective (assessing the effectiveness of the used process). RQ 4.0 is related to this research objective and to increase construct validity this question is answered with multiple sources of evidence (Yin, 2014). Through the results of the two round Delphi it is possible to see if the process produces desirable results. However, desirable results do not guaranty that the used process is also efficient. To determine the efficiency the participants were asked three questions at the end of the second Delphi round. This allowed the effectiveness of the used process to be assed based on the results and the statements of the participants.

3.6.8 Reliability

When reliability of the Delphi method is discussed it often concerns the reliability of forecasts that it produces. This however is not what the method is used for in this study. Therefore to facilitate reliability, a clear description is given of: the context of this study, the selection criteria for participants, the data collection process and the process of analysis (Graneheim & Lundman, 2004) (Elo & Kyngäs, 2008).

The reliability general reliability of interviews has been discussed in section Reliability3.4.2.

3.7   Second research objective conclusions

Through the methodology described in section 3.6 it was possible to achieve the second research objective (assessing if the type of process used in this thesis is effective for achieving business-IT alignment). The two round Delphi study functioned as a test case for the process. Through the Delphi study RQ3.0 could be answered. By structuring the results of the Delphi study with a Metaplan session *research output 3* could be produced. Through the *research output 3* and the questions asked at the end of round two it was possible to answer RQ4.0. Which meant the second research objective could be completed.

External validity

The degree to which the findings of the Delphi study are generalizable to beyond this immediate study are similar to the results of the first research objective, which is described in section 3.5. This is because the participants that participated in the Delphi study also participated in the multiple case study.

The CC-VNs of the participants have different compositions and characteristics. Meaning the results are generalizable to CC-VNs. The external validity is further increased through seeking divergence during the second Delphi round rather than convergence. As convergence would increase the degree to which the results are more applicable to the CC-VNs of the participants.

4 Results

This chapter presents the results of each methodology that was applied in this study. At the start of each section related research objectives, questions and outputs are stated.

4.1 Structured literature review results

The SLR served stage one of the first research objective (developing the KTI classification framework). Through the SLR the following research question is answered:

> **RQ 1.0**: Which KTIs are mentioned in related literature?

The review protocol resulted in a set of 54 publications that have been selected for full review and data extraction, the full list of publication is presented at the end of Appendix B. The data extraction resulted in a total of 152 tacit KTIs and 117 explicit KTIs (after duplicate removal, this was done by two members of the research group). These KTIs were put onto cards, two examples of such cards are given in Figure 7.

security issues	Interviewees stated that in many cases there is no control on data exchange and the level of transparency within the PLM and ERP systems used, which can cause risks due to the Intellectual Property involved.
(Madenas et al., 2015)	
Failure in sharing and retaining contextual knowledge	Since network members are dispersed across multiple locations, contextual knowledge seems to be held uniquely and tends to be unevenly distributed among team members
Alavi, M. and Tiwana, A. (2002)	

Figure 7: Example of an explicit issue card and a tacit issue card

Due to space considerations the full list of cards are not listed here or in the appendix, but it is made available on www.researchgate.net[5]. However, the KTIs and their sources are stated in Appendix B.

4.2 Knowledge transfer issue classification (using the Metaplan method) results

The Metaplan method served stage one of the first research objective (developing the KTI classification framework). Through application of the Metaplan method the following research output is produced:

> **Research output 1**: KTI classification framework

A total of three Metaplan sessions have been held, in which each session after the first continued with the results of the previous session. There was no need for a fourth Metaplan session, because no changes were made in the amount of clusters during the third session, meaning the set of clusters stabilized. For a more detailed description of the process see Appendix B. The resulting KTI classification framework is shown in Table 4. It consists out of six main categories and 29 KTI.

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[5] https://www.researchgate.net/publication/300124689_SLR_Tacit_and_explicit_knowledge_transfer_cards

KTI-ID	Issues	Description given during Metaplan sessions
	Network structure issues	
A	Transactive memory issues	Refers to the set of knowledge possessed by group members coupled with an awareness of who knows what.
B	Relationship issues	Collaborations between actors are hindered because of personal relationships. One firm feels superior over the other.
C	Complex network issues	Extreme complexity in terms of relationships, communications and the assembly and use of knowledge.
D	General distance issues	Physical or time distance between actors creates difficulties in knowledge sharing.
E	Cultural distance issues	All actors must know each other's respective cultural backgrounds. Views and ideas can be negatively influenced by not knowing languages people speak, their habits, and what is acceptable and what is not.
F	Lack of communication facilities	Lack of opportunities for communication and lack of formal/informal mechanisms, making it difficult to transfer knowledge across a network.
	Generic issues	
G	Difficulty in expressing tacit knowledge	People are unable to externalize/codify their tacit knowledge.
	Social issues	
H	Knowledge source reliability issues	Knowledge is not perceived as true because its source is unreliable.
I	Fear of losing knowledge	Since knowledge is a source of competitive advantage, there is fear that when it is shared, it is shared with partners that could be competitors.
J	Lack of willingness	People don't want or are unmotivated to engage in knowledge sharing for reasons including knowledge as a power syndrome, lack of trust in people, resistance to change, or fear of exploitation.
K	Lack of trust	A belief that the other party might act opportunistically or in an unfavorable way hinders knowledge sharing across a network.
	Language / understanding issues	
L	Insufficient mutual understanding	Unable to make good use of the others' knowledge due to a lack of common ground, casual ambiguity, difference in perception, or lack of knowledge of exactly how the knowledge is supposed to be used.
M	contextualization issues	Context can be defined as information about the situation, intentions, and feelings about an issue or action. Losing the context of knowledge can be an issue, especially for tacit knowledge.
N	Semantic issues	Use of different terminology or different meanings of words can cause misunderstandings.
	Organizational aspect issues	
O	Organizational issues	The organization does not have sufficient formal planning, guidelines or regulations for knowledge sharing. This makes it unclear who is responsible, and what and how data should be shared.

P	Lack of top management commitment	Due to lack of top management commitment and involvement, knowledge sharing initiatives lack a mandate, causing them to fail.
Q	Network level objective / benefit issues	Given power asymmetry and goal problems at the network level, actors do not equally benefit from knowledge sharing.
R	Insufficient resources	Lack of resources such as expertise, training, time, funds, and network structure cause difficulties for knowledge sharing.
S	Organization structural issues	Inflexibility results from excessive hierarchy and centralization, or too many guidelines and regulations. People may be willing to share, but lack the authorization.
T	Lack of incentive	People are not motivated to share their knowledge due to a lack of incentives in the form of accolades or rewards.
U	Authorization / data flow	Data exists but is not mobile. People cannot access it and therefore they cannot derive value out of it.
V	Performance measurement issues	Without monitoring control and evaluation procedures it is impossible to tell how KM system is performing.
W	Legal issues	Laws and regulations may put constrains on inter-organizational knowledge sharing.
	Technical issues	
X	Failure to meet technological demand	Technology in place is inadequate (e.g. lack of functionality, architectural issues, system security) to support a network's actual knowledge transfer process.
Y	Lack of user-friendly IS	The system is not adequately user friendly.
Z	Data quality issues	Refers to availability, privacy, accessibility, accuracy, and completeness of shared data.
AA	Data overload issues	There is more data available than that there is processing capacity available.
AB	Data security issues	Technological issues generate reliability and security concerns in knowledge transfer.
AC	Data integration issues	Different information systems are not capable of exchanging data.

Table 4 KTI classification framework resulting from the Metaplan sessions

4.3   KTI classification framework validation results

The multiple case study served stage two of the first research objective (validating the KTI classification framework in the context of CC-VNs).
Through the multiple case study the following research questions are answered and the following output is produced:

RQ 2.0: Which KTIs occur in CC-VNs (validation of the KTI classification framework)?

RQ 2.1: Which KTIs are considered most important by practitioners?

Research output 2: Validated, enriched KTI framework

The results of the multiples case study that has been conducted used semi-structured interviews to collect data, which was used to validate the KTI classification framework. A total of eight cases have been studied, in which semi-structured interviews have been conducted experts that work in the context of CC-VNs. During these interviews the interviewees gave concrete examples of instances where they came into contact with a KTI in practice. These examples have been labeled independently by the author and another member of the research group. After which they had a meeting to compare the labeling and discuss the differences. When they could not agree on a label after discussing it, the example was discussed with the entire research group. This process worked well and became more efficient over time, because the initial independent labeling of the researches became more aligned over time, as is shown in Figure 8.
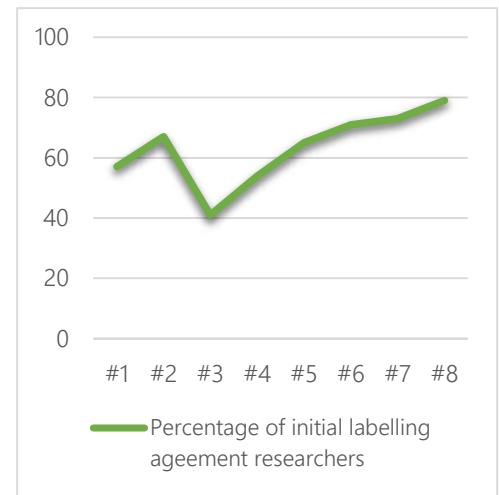
Figure 8 Initial labelling agreement researchers

4.3.1 Stopping criterion

No additional experts were interviewed after the eighth interview, because with the eighth interview 28 of 29 the KTIs were validated with strong examples. For the non-validated KTI '*Lack of communication facilities*' all of the interviewees indicated that this KTI was outdated and a new KTI '*Too many communication channels*' was discovered which supports the invalidation of KTI '*Lack of communication facilities*'. Meaning that 28 out of 28 KTIs were validated and saturation was achieved.

4.3.2 CC-VN mapping

The cases have been characterized on the six dimensions of the SODSC framework (Rasouli, Kusters, Trienekens, & Grefen, 2014). Based on the drawings the interviewees made of their CC-VNs and the
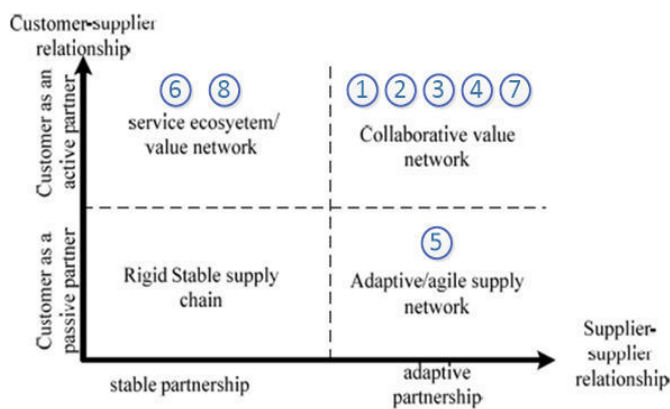
Figure 9 Characterization of the partnership aspect

explenation that they gave during the interview. This processes was supported through consulting the reasoning of a ealier case study in which the SODSC framework was used (van Beek, 2015). In Figure 9 it is shown how the eight cases have been characterized on the partnership aspect. The other dimentions, the retionale for the positioning and how the cases score overal on the SODSC is stated in Appendix C. Through these characterizations it is made certain the cases which have been studied do not operate in supply chain contexts.

4.3.3 Data collection through semi-structured interviews

As suggested by Tong, Sainsbury, & Craig, (2007), information about the relationship between the interviewer and the interviewees is provided in Appendix C.

The interviewees were explained the purpose and outline of the research. After that they were asked to make a drawing of their CC-VN. They were explicitly asked how the customer could be placed in the network. This

activity clearly defined the network horizon of the case and helped in establishing report with the interviewee. Anonymized versions of these drawings are provided in Appendix C.

A distinction has been made between *strong* and *weak* examples of KTI. A strong example is a concrete example in the context of CC-VNs. A *weak* example means a general description of the occurrences of a KTI was given without a concrete/elaborated example. *Internal* examples *of* have also been registered but they are not used in the validation of the KTI classification framework, as these example are not in the right context.
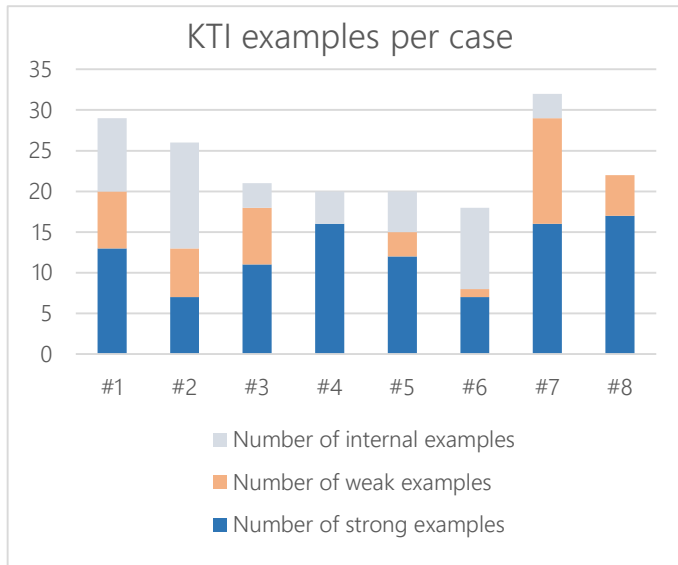
Figure 10 Number of KTI examples given per case

On average 23 examples were given per interview, this average includes *strong*, *weak* and *internal* examples. The number of *strong*, *weak* and *internal* examples given per interview is presented in Figure 10. The fact that the interviewees that provided the least amount of *strong* examples (seven), gave a relatively high amount of internal examples, shows that they understood the questions they were asked. As they were able to provide a 'fitting' example, however, in the wrong context to be relevant for the validation of the KTI classification framework. In Appendix C an overview is given of, how many examples per category came from each case and how important the categories are considered by each of the interviewees.

4.3.4 Validating and enriching the KTI framework

Through the case studies 28 of the 29 KTI have been validated with *strong* examples. KTI: '*lack of communication facilities*' has not been validated. The general response of interviewers to the KTI was that it is an outdated issue. During the interviews the interviewees were also asked if the KTI classification framework is complete. As a result of this one new KTI has been discovered and added to the KTI framework: '*Too many communication channels*'. This KTI is defined as follows*: There are too many communication channels available, making it difficult to assess what is the right channel to use for a message. Do people read every channel? Is the channel appropriate for the message?* The discovery of the '*Too many communication channels*' KTI supports the invalidation of: '*lack of communication facilities*'. Interviewees also mentioned '*difficulties to find new partners*' and '*difficulties to find temporary partners for specific tasks*'. But these issues have not been included in the KTI framework because these issues are more related to 'operating in a VN' than to knowledge transfer.

Table 5 Presents statements made by the interviewees that validate a KTI. These statements have been translated from Dutch to English and have been condensed. A more elaborate overview of the statements of the interviewees and the results of the labeling can be found in Appendix E. In Table 5 an orange background means the KTI has not been validated and a green background means that the KTI has been added to the KTI framework.

KTI-ID	Issues	Examples
	Network structure issue	
A	Transactive memory issues	#4: Customers ask questions about services we can't deliver but our partners can.
		#5: Found out late that partners also had plans to go abroad.
B	Relationship issues	#1: A partner has better relations with end customers.
		#8: Large network members find themselves more important than others. They are demanding in what they want
C	Complex network issues	#4: Two partners are each other's largest competitors.
		#7: Project goals become fuzzy when a lot of parties are involved.
D	General distance issues	#1: It makes communication and the sharing of resources such as experiment-settings hard.
E	Cultural distance issues	#7: With some cultures I have to spend a lot of time in becoming accepted
F	Lack of communication facilities	#3: No, not an issue. Especially not in these days. Internet solves it all.
		#5: No, does not ring a bell.
AD	Too many communication channels	#7: We have so many channels that we have to formulate a policy for what we put on which channel.
	Generic issues	
G	Difficulty in expressing tacit knowledge	#1: Explaining how to communicate with customers.
		#4: Some technical staff should not talk with customers as they give things away for free.
	Social issues	
H	Knowledge source reliability issues	#5: Sometimes it is in our partner's interest to provide us with wrong information.
		#5: The validity of the research of an intern, can I share it with partners
I	Fear of losing knowledge	#3: 5 guys said they came to talk but just provoked an architect in to leaking knowledge.
J	Lack of willingness	#2: People still prefer using email instead of new systems.
K	Lack of trust	#1: Some partners want exclusive rights. They worry that the customer will go straight to us.
	Language / understanding issues	
L	Insufficient mutual understanding	#3: Partners have a different view, they look at one item while we look at the whole process.
		#4: Not every employee of customers has a technical background.
M	contextualization issues	#5: Partner does not understand why I have a problem with a situation.
		#6: A customer gave specs in 1mm, but our systems works with 0.5mm.
N	Semantic issues	#2: Terms have very wide ranging definitions. Everyone has its own perception of these terms. We constantly have to try to align these definitions.

	Organizational aspect issues	
O	Organizational issues	#2: No formal guideline (yet) for documenting customer contact. #3: Compliance to guidelines. #8: No power hierarchy in the network
P	Lack of top management commitment	#7: I have never encountered that a customer had a clear vision on knowledge sharing in their organization. #8: Some members of a part of the network are told by their employer that they should not put any time in network efforts.
Q	Network level objective/ benefit issues	#4: Partners are open to suggestions but must know the costs and who else could be interested. #5: Partners feel they don't benefit as much as us.
R	Insufficient resources	#2: The risk of knowledge remaining in your head due to time documenting requires. #7: No resources to collaborate with everyone that approaches us.
S	Organization structural issues	#4: Directs have to pass through 3 parties.
T	Lack of incentive	#2: individuals that work for partners are rewarded more for direct sales than indirect sales.
U	Authorization/data flow	#1: Data from customers is classified. #4: Sometimes customers don't share new developments.
V	Performance measurement issues	#8: There is data, but no evaluations are done. There is an attitude of 'as long as it going fine… it's going fine'
W	Legal issues	#6: Production data has to be anonymized before testing.
	Technical issues	
X	Failure to meet technological demand	#6: For a particular problem we can't use our partner's technology.
Y	Lack of user-friendly IS	#1: New system has so many options that there is a learning curve.
Z	Data quality issues	#2: Data is time bound, knowledge ages, technologies change, organizations change, customers change. #7: Ideas of managers are not possible because data is not present or of poor quality.
AA	Data overload issues	#6: During a process all kinds of things are called upon and the data explodes.
AB	Data security issues	#7: People overreact and they seal everything, so that they can't even access their own data.
AC	Data integration issues	#3: One system is not able to store a second registration before it is connected to another system.

Table 5 KTI framework with KTI examples from participants

Recognition percentage	KTI ID
87.5	B
75	J
75	L
75	N
75	O
75	R
75	W
62.5	D
62.5	K
62.5	Q
62.5	U
62.5	Z
62.5	AC
50	A
50	C
50	E
50	M
37.5	G
37.5	H
37.5	I
37.5	P
37.5	AB
25	S
25	V
25	AA
12.5	AD
12.5	T
12.5	X
12.5	Y
0	F

Table 7: Percentage of participants that recognized a KTI

Average importance	KTI ID
2.5	AB
2.5	AD
2.4	AC
2.3333333	J
2.25	H
2.2	C
2	I
2	O
2	P
2	R
1.8571429	L
1.8571429	N
1.8571429	Z
1.8333333	D
1.8333333	M
1.8333333	U
1.8	AA
1.7142857	B
1.6666667	W
1.6666667	Q
1.6666667	V
1.6666667	K
1.6	E
1.5	A
1.5	G
1.3333333	S
1.3333333	Y
1	F
1	T
1	X

Table 6: Average importance rating of given examples

Table 7 shows how many participants gave an example of a particular KTI. This includes both strong and weak examples (When a participant gave a weak and a strong example for a KTI only the strong example is used).

Table 6 shows the average importance that participants gave to a particular KTI. The 'importance rating' ranges from 1 to 3. Where '1' means the KTI is not considered important, '2' means the KTI is not important but also not unimportant and '2' means that the KTI is important. Similar to Table 7 when a participant gave both a strong and a weak example for the same KTI only the importance value of the strong example is used. On rare occasions it occurred that a participant gave multiple strong examples, in these cases the highest importance rating was used. During interviews where enough time was available the participants were asked for indications regarding the importance of KTIs they did not provide examples of. These indications of importance have also been used in calculating the average importance of the KTI.

The fields that are marked green in Table 6 and Table 7 have been selected as 'most relevant' for the Delphi study which is done to achieve the second research objective. The selections were made based on seven cases the Delphi study started before the eighth interview was conducted. The tables that were used for this selection are included in appendix C, accompanied with a concise reason for each KTI, why it was or was not selected for inclusion in the Delphi study.

4.4 Comparing the proposed KTI Framework to other related frameworks

The comparison of the KTI to other related frameworks served stage two of the first research objective (assessing how the KTI framework compares to related frameworks). Through the comparison the following research question is answered and the following output is produced:

> **RQ 2.2**: How does the KTI framework compare to related frameworks?

This section presents the results of the comparison of the KTI framework against related frameworks. These related frameworks were used as input used to develop the KTI classification framework.

The comparison is done on six aspects (descriptions are stated in section 3.4). Table 8 presents the results of the comparison for the aspects *development methodology*, v*alidation, the number of mentioned KTIs in the related framework, the number of KTI framework KTIs mentioned* and *Missing KTIs.* In the column '*missing*

KTIs' the KTI-IDs are used (stated in Table 5). KTI 'F' (too many communication facilities) is listed between brackets because this KTI was not been validated in practice. When calculating the number of KTIs this 'F' is not included. Appendix F elaborates on the limitations and discusses them concisely.

The column '*number of KTI framework KTIs mentioned*' states how many KTIs of the KTI framework are included in the related framework. For example Duan, Nie and Coakes (2010) mention 23 KTIs, these 23 KTIs can be mapped to twelve KTIs of the KTI framework. Hence the framework of Duan, Nie and Coakes (2010) covers 41% of the KTI framework. From this it can also be concluded that the KTI framework has a higher abstraction level than the framework of Duan, Nie and Coakes (2010).

Source	Development Methodology	Validation	*number of mentioned KTIs*	*number of KTI framework KTIs mentioned*	Missing KTIs
This thesis	SLR, Metaplan	Multiple case study, Semi-structured interviews	29	29	n.a.
(Duan, Nie, & Coakes, 2010)	Delphi	Delphi	23	12 (41% coverage)	A, C , D, G, H, N, O, P, Q, V, W, X, Y, Z, AA, AB, AC, AD
(Lin, Wu, & Yen, 2012)	revised CHAT model	Delphi	12	7 (24% coverage)	C, G, M, Q, S, V, W, X, Y, Z, AA, AD,
(Pirkkalainen & Pawlowski, 2014)	LR + "categorization approaches identified in the literature"	None	60	20 (69% coverage)	B, C, H, I, N, U, Z, AA, AD,
(Hong, Suh, & Koo, 2011)	None	Survey	8	7 (24% coverage)	A, B, C, (F), G, I, K, M, N, O, P, Q , R , U, V, W, X, Y, Z, AA, AB, AC, AD
(Paulin & Winroth, 2013)	none	comparative research design, semi-structured interviews	19	15 (52% coverage)	A, C, M, N, O, Q, S, V, W, Y, Z, AA, AB, AC, AD,
(Haug, et al., 2013)	LR with description. No method for classification	survey	12	7 (24% coverage)	A, B, C, D, E, (F), G, H, I, J, K, L, M, N, Q, S, U, W, Z, AA, AB, AC, AD
(Howard, Vidgen, & Powell, 2006)	Multiple case studies. No method for classification	multiple-case approach, semi-structured interviews	14	10 (34% coverage)	A, B, D, E, (F), G, H, I, L, M, N, O, Q, T, V, W, Z, AA, AB, AD
(Yang & Maxwell, 2011)	LR, method: Webster and Watson (2002). No method for classification	None	15	11 (38% coverage)	A, B, C, D, (F), G, H, I, M, N, P, R, U, V, W, Z, AA, AB, AC, AD

Table 8 Comparison of the KTI framework with related frameworks

4.4.1 Observations

The KTI framework fills a literature gap. It is compared to related frameworks to determine what the KTI framework adds to existing literature. The following observations can be made:

- Other frameworks rarely focus simultaneously on tacit and explicit issues. Implying that the scope of KTIs included in the KTI framework is broader.
- Many of the related frameworks focus on KTIs at lower abstraction level.
- Differences in the main categories (highest abstraction level) used to divide the KTIs into smaller groups. The main categories of other frameworks are usually from a different point of view. For example instead of having the main categories on the types of KTI (which is done in the KTI

framework), some frameworks have their main categories based on *who/what* is experiencing or causing a KTI.

- None of the frameworks mention 'Z', 'AA' or 'AD'. Haug, et al., (2013) does focus on what causes 'Z' (data quality issues) but it is not mentioned as a KTI itself.
- None of the other frameworks pay much attention issues that might be more prominent in network settings, such as 'A', 'C', 'U' and 'V'.
- None of the other frameworks have a scope of KTIs as wide as the KTI framework.

From these observations it can also be concluded that these eight related frameworks were not sufficient to develop the KTI classification framework. Because some of the KTIs that are included in the KTI classification framework are not mentioned in these related frameworks. Thus the other 46 publications selected during the SLR contributed to the completeness of the KTI classification framework.

4.5   Two round Delphi study results

The two round Delphi study served both stages of the second research objective (the discovery of solutions in the form of ICT functionalities and establishing if the process that has been used throughout this study has been effective). Through the two round Delphi study the following research questions have been answered and the following research output is produced:

> **RQ 3.0**: What types of ICT functionalities can help to solve the most relevant KTI in CC-VN contexts?

> **Research output 3:** A collection of ICT functionality types

> **RQ 4.0**: Has the process used in this study been effective?

The two round Delphi study has been conduct over a period of two months, with one week between the end of the first round and start of the second round. All eight experts that participated in the *KTI classification framework validation interviews* participated through the entire two round Delphi study (no attrition occurred).

4.5.1   Delphi round one

During the first Delphi round the participants were ask to state ICT functionalities which they thought could solve a particular KTI for their CC-VN. For each suggested ICT functionality they were also asked to provide a rationale for '*why*' the functionality would help in solving the issue. Although there was no restriction participants mostly stated one or two ICT functionalities per KTI. A possible explanation for this could be that there was only one hour available for the interview in which ten KTIs were covered. After each interview the participants were sent a sort summery of the interview, with a more detailed report as attachment. The participants were explicitly asked if to state if their input had been interpreted correctly. Only one participant provided this conformation. Therefore, during the interview of round two, the participants were asked again to confirm that their input had been interpreted correctly.

During round one the participants mentioned a total of 120 distinct solutions. A distinction was made between ICT functionalities and solutions that had procedural aspects. Only when two participants stated exactly the same functionality their input was merged. These solutions and the rationale given by the participants for these solutions are presented in Appendix G, in the protocol of round two.

4.5.2 Delphi round two

During the second Delphi round the participants were asked to confirm if their input from round one had been correctly included in the feedback for round two. Participants could generally recognize their own input. Although there were also instances where participants thought the input from other participants (which they marked as '*important*') was their own input. None of the participants indicated that they were missing their own input in the feedback of round two.

Participants were asked to first mark which suggested ICT functionalities they deemed '*useful*' for their CC-VN. After that they should mark which of these 'useful' functionalities were '*important*'. A first observation that can be made is that all participants considered their own input as either '*useful*' or '*important*'. Participants generally also considered functionalities which they had personal experience with as '*useful*' or '*important*'. The usefulness and impotency indications for each ICT functionality are stated in Appendix G in the protocol of round two. After indicating the usefulness/importance of functionalities for each KTI, the participants were asked if they could suggest additional functionalities after seeing the input from others. A total of eleven additional functionalities were suggested during round two. These 11 functionalities are stated in Appendix G.

4.5.3 Classifying ICT functionality types

To structure the 131 suggested solutions, a Metaplan session was held by three members of the research group to produce *research output 3*. The fourth member of the group provided extensive feedback on the results of the session. During this Metaplan the session the solutions were classified into 24 clusters. These clusters have been grouped into categories two main categories: '*Tools that facilitate working remotely*' and '*Non ICT solutions*'. The former main category is composed out of six sub-categories. The definitions of the functionality types and the individual ICT functionalities which they include are stated in Appendix G.

4.5.4 The importance of functionality types per KTI

Through analyzing the ICT functionality types (*research output 3)* is it possible to create an overview of which functionality types are useful/important for solving a particular KTI. Such an overview enables CC-VNs to determine which ICT functionality types to employ for KTIs they want to solve/prevent. In other words, it can assist them in getting the best use out of IT resources to meet their objectives i.e. achieve BIA.

The usefulness and importance of functionality types is linked to individual KTIs in Table 9. The importance of functionality types is determined based on the ICT functionalities which it includes. The participants have marked these ICT functionalities as *useful* and *important*. The numbers shown in Table 9 reflect the average of this.

An example for clarification:

> [5(3)] Making appointments

[5(3)] means that two participants marked the functionality as *useful* and three marked it as *important*. Because '*import*' implies is it considered *useful* the number of usefulness and importance indications are added, hence resulting in five indications for *useful* and three indications for *important*.

ID	Total average	Complex network issues (c)	Lack of willingness (j)	Insufficient mutual understanding (l)	Semantic issues (n)	Organizational issues (o)	Insufficient resources (r)	Authorization / data flow (u)	Legal issues (w)	Data quality issues (z)	Data integration issues (ac)
Tools that facilitate working remotely (Main category of ICT functionality types)											
Tools that facilitate working remotely	6(2)							6(2)			
General ICT functionalities											
A shared online environment	5.8(3.7)	8(4)	4(3)	6(3)			7(6)	5(3)	5(3)		
Increasing accessibility of information	n.a.		N					N			
Unique functionalities											
E-learning	7(3)						7(3)				
Mind map techniques	7(2)		7(2)								
Communication support											
Real time communication	6.1(3.7)	6.3(4)					6(3.5)				
Gamification	3.5(1.5)		4(2)				3(1)				
Locating knowledge	6(3.5)		7(4)	6(3)			7(4)	4(3)			
Forum functionality	5.5(2.6)	6(2.3)	5.7(3)	4.3(2.7)			6(3)				
Process support											
Task management	6.6(3.6)	6(2)				8(3)	7(6)	6(3.5)			
Making appointments	5(3)	5(3)									

ID	Total average	Complex network issues (c)	Lack of willingness (j)	Insufficient mutual understanding (l)	Semantic issues (n)	Organizational issues (o)	Insufficient resources (r)	Authorization / data flow (u)	Legal issues (w)	Data quality issues (z)	Data integration issues (ac)
Document management systems (two sub categories)											
Document management systems	6(2)			6(2)							
Documentation											
Documentation	5.9(3.7)	8(7)	6(3)	5(2.2)	6.3(3.8)	6.1(4.4)	6.3(4.3)	4.5(3)	6.5(3)		
Data / document management											
Version control	6(2)	6(2)									
Adherence to and application of laws and regulations	6.3(4.7)								6.3(4.7)		
Authorization	7.2(4.7)	8(5)						6(4)	7(4.7)		8(5)
Anonymization of data	n.a.									N	
Clarify definitions	5(3.8)				8(5)			4.3(3.3)			
Data input quality	7.3(5.4)									7.3(5.4)	
System integration related functionalities											
Connecting Systems	7(6.2)	6(3)									7.2(6.8)
Data exchange between systems	7.5(5.3)										7.5(5.3)
Non ICT solutions											
Processes and agreements	6.7(4.7)	7(3)	6(3)	N			7(5)	5(4)		7(5)	8(8)
Trust and relations	6.8(4.8)	8(5)		7(5)	6.5(5)			6.6(4.6)			
Hire new staff	4(3)						4(3)				

Table 9 Usefulness and importance of ICT functionality type per KTI

4.5.5 Average importance of ICT functionality type categories

With the data that was collected during Delphi round two, it is possible to create an overview of the relative importance each participant assigned to a particular category of solutions. ICT functionalities that are market as *useful* are assigned a value of '1'. ICT functionalities that are market as *important* are assigned a value of '2'. Some suggestions could be considered 'bad' because less than four participants considered it *useful*. This could be because the suggestions were poorly formulated or lacked nuance. Therefore these suggestions have been filtered out before calculating the average importance of the categories, because this would mean that categories that contain more ICT functionality suggestions are considered of lesser importance by default.

Because the participants were not restricted in how many functionalities they could mark as *important,* the results are quite diverse. Participant #1 does not score high on *average importance* because he was more selective in marking suggestions as *useful* or *important*. Another participant that stands out is participant #7, because he scores high on all categories. This can be explained through the fact that participant he had personal experience with almost all suggested solutions due to his line of work.
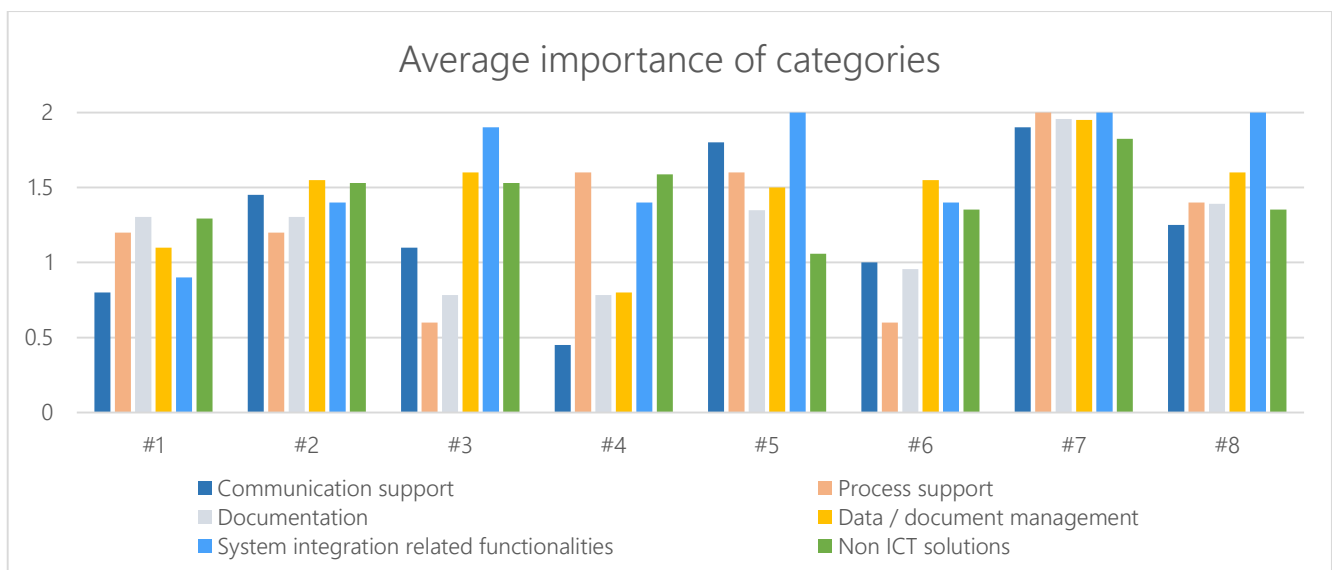
Figure 11 Average importance of functionality type categories

4.5.6 Assessing the effectiveness of the used process (RQ4)

At the end of Delphi round two, the participants were asked three general questions about the research. The following summarizes their answers (Quotes of their answers are included in Appendix G.):

- Five (out of eight) participants stated that they were already using solutions which were mentioned by other participants.
- Two participants stated that the suggestions require some kind of action before they really achieve grip on the KTIs.
- Six participants stated that it is nice to see the input of other participants (it followers an extensive overview of the available solutions).
- All eight participants stated that they found 'the process' useful. The structure helps them in coming up with solutions and it is useful to see the input from others.
- Two participants stated they were skeptical that KTI can be solved with ICT.
- Three participants stated that they would have found to process more useful if less emphasis was put on ICT.

Overall the participant found their participation the research useful. The process makes them consciously think about the concept of knowledge transfer and how it can be facilitated. Although some would have

liked the research to be aimed more at the social aspects of collaboration. All eight participants were positive about the process itself. None of the participants indicated that the process took too much time or could be improved in another way. Through the answers of the participants and the result that produced (*research output 3*) it is possible to conclude that the used process in this study is effective for achieving BIA (RQ 4.0, *second research objective*).

5   Discussion

In this chapter the effectiveness of the used methodologies and their contribution to achieving the research objectives is discussed. It further discusses if measures taken to facilitate reliability and validity have been sufficient. In this chapter possible improvements for the applied methodologies are also suggested.

In the chapter discusses the methodologies in the order in which that have been applied, similar to Chapter 3 and Chapter 4.

5.1   Systematic literature review

During SLR resulted in a collection of 54 publications from which 269 KTIs were extracted. From the observations of the framework comparisons in section 4.4.1, it can be concluded that the scope of the SLR was correctly chosen and that the concept was completely covered, hence the chosen Boolean operators and chosen search space were adequate (construct validity). The independent data extraction by two researchers, which was done to facilitate reliability, worked well; as they independently extracted complementary data. This makes it unlikely that there are KTIs which have been overlooked, increasing the quality of the KTI classification framework which was required for the first research objective.

The publications that were included for data extraction formed a complete set. Section 4.4.1 shows that if only the publications containing frameworks would have been included, the resulting KTI classification framework would not have been as comprehensive as it is with the inclusion of other publications. The fact that the KTI classification framework was developed with the inclusion of other publications also benefitted other methodologies that have been applied in this study. During the multiple case study the results of the Metaplan method were frequently used to assist in determining how the example of an interviewee should be labeled. The fact that these results contained a large variety of less abstract KTIs proved helpful.

5.2   Knowledge transfer issue classification (using the Metaplan method)

The predefined criteria for evaluating classification methods made it possible to compare the varying available methods. Based on the results of this comparison the Metaplan method was selected. In three Metaplan sessions satisfactory results were achieved (the KTI classification framework). The open atmosphere which was created made sure that all participants felt free to share their thoughts and opinions (internal validity). It contributed to constructive discussions regarding the placements of cards into clusters and the abstraction level of these clusters (construct validity). To facilitate reliability two abstraction levels were introduced. Should the process be repeated, it is more likely that the results will match one of the abstraction levels.

Doing additional sessions after the first session contributed to the end result as the amount of clusters changed during later sessions. This contributed to the quality of the first research objective as it directly improved the KTI classification framework. During the third session only cards were moved from cluster to cluster. This further contributed to the *first research objective* (developing and validating the KTI framework) because, during the validation of the KTI classification framework the results of the Metaplan session were often consulted, to assist in the labeling of statements from interviewees.

In hindsight it would have been helpful to number the KTI cards as this would have contributed to the efficiency of the method. This would make it possible to, for example, document that card-X is a duplicate of card-Y. The clusters that have been formed during the sessions could also have been numbered immediately. This would have made it a lot easier to keep track of how a particular card moved from cluster to cluster. Without the numbering this proved to be a time consuming process.

5.3   Validating the KTI classification framework through a multiple case study

The selection criteria for cases proved sufficient. This has been verified through mapping the cases on the SODSC framework. The drawing that interviewees were asked to make of their CC-VN facilitated the mapping of the cases, because, through the drawing it was possible to determine the network horizon of the cases. Without the drawing this would have been very difficult to determine (construct validity).

The protocol that was used for the interviews was designed specifically to determine which KTIs the interviewee experienced in their network. Reserving plenty of time for the introduction paid off. This includes asking participants to draw their CC-VN. This made it easier for the interviewer to understand the CC-VN of the interviewee, how each partner contributes to the network and how customers are involved. This drawing was used actively in all eight interviews by both interviewer and interviewee to clarify questions and answers. During the introduction the purpose of the interview was also elaborately explained. Taking the time to elaborately explain the kind of answers that could be used in the study greatly reduced the time required to conduct the interview and improved the quality of the answers given by the interviewees.

The interviewer was aware of the risks of asking suggestive / leading questions and paid attention to formulating questions as neutral as possible. While transcribing the interviews self-reflection was applied and close attention was paid to the way questions were asked. Through this activity the results of later interviews were improved. Listen critically to examples of interviewees and probe the interviewee for elaboration on examples improved the quality of the results. Because without probing some of the examples would not have been elaborate enough to be labeled as a *strong* example.

Although it was not expected that any new KTI would be discovered that was not already included in the KTI classification framework, the active search for additional KTIs contributed to the completeness of the KTI framework as 'too many communication channels' was added. The results of the 'open questions' confirm that the reliability of the interviews is improved through using the KTI classification framework. During the 'open questions' interviewees were asked which KTIs they experience without being triggered by the definition of a KTI from the KTI classification framework. On average interviewees were able to state 3 to 4 examples before running out of examples. While through structure provided by the KTI classification framework they were able to give a lot more examples. This suggests that without use of the KTI classification framework, it is highly unlikely that the examples gained through the interviews would have been sufficient validate the 29 KTIs in the KTI framework. Hence the choice to complete the *first research objective* (developing and validating the KTI framework) through the development and validation of a KTI classification framework was correct. Omitting the development of a framework based on existing literature and applying grounded theory, would have negatively affected the quality of the KTI framework.

Sending interview reports to the interviewees and asking them if they had any remarks resulted in one interviewee providing feedback. The silent consent of the other seven interviewees can be interpreted in two ways: (I) they reviewed the interview report and did not have any remarks, (II) they did not review the report. In hindsight it would have been better to ask the interviewees to also send confirmation if they did not have any remarks.

In hindsight it would have been convenient to pay to identifying the characteristics of the network. This would have made it easier to map the cases on the SODSC framework. However, this would have made the already complex interview more complex and perhaps confusing to the interviewees.

5.4 Network comparisons

Eight frameworks were found in the publications selected during SLR, these publications being of recent nature allowed a good comparison with existing literature (construct validity). Illustrating the value of completing the first research objective.

Defining aspects on which the frameworks provided a structured way of doing the comparison (reliability). Using the results of the Metaplan session was very useful, next to the fact that it increases it reliability it also makes the process of comparing frameworks more efficient.

The observations that have been made based on the comparison show how the KTI framework adds to existing literature. This does not mean that all of the related frameworks have become obsolete. They should however not be used for the same purposes. Some related frameworks approach KTIs from a different angle (who / what is causing a particular KTI) and apply a different abstraction level.

5.5 Delphi study

The two round Delphi study was conducted with eight participants, which had previously participated in the multiple case study. The interview protocol for the first round was tested in a pilot interview. As a result from the pilot interview some of the questions were reformulated to better align with the research objectives. This was not possible for the interview of the second round. To compensate for this, after the first interview of the second round the protocol was optimised (construct validity).

To avoid the issue of *silent consent* that occurred during the validation of the KTI classification framework. The participants were asked to confirm that their input had been correctly interpreted. To reduce the workload on the participants a concise summary of their input was provided. As a result from this one participant confirmed that his input had been correctly interpreted. For this reason the participants were also asked to confirm their input during the second round (construct validity). In hindsight it might have been necessary to explain the experts during the first validation interview the importance of confirming correct interpretation.

The results of the Delphi study were structured through a Metaplan session. This session was held with three members of the research group rather than the recommended four. To compensate for this the fourth member provided extensive feedback on the results.

The Delphi study functioned as a test case to complete the second research objective. The effectiveness of the process has been established through the result produced by the Delphi study and the questions that were asked at the end of the second round. The result of the Delphi study that is shown in Table 9 makes it possible to determine what kind of ICT functionality types are relevant for solving particular KTIs. The questions that were asked at the end of the second round provide certainty that similar results could not have been achieved in a more efficient manner. During these questions some participants expressed their concerns regarding solving KTIs through ICT solutions. The rationale being that: *if a situation occurs where collaboration is not sooth, introducing ICT solutions would mean that the personal contact is reduced, which could make the situation even worse*. It is important to recognize that there are many possible solutions for KTIs, as is illustrated in section 2.5.1. Therefore ICT solutions might not always be the most appropriate solution. Generally participants experienced their participation in this study as useful because it increased their awareness of KTIs and of possible ICT functionalities that can be employed against them.

Figure 11 shows how important participants consider ICT functionality types on average. It is importance to look at the 'relevant' importance of categories per participants, because an importance value of '1.3' can be extremely high for one participant while being low for another participant. Looking at the 'top 3' of each participant shows that *communication support* and *documenting* are generally considered to be of

lesser importance. The categories *system integration related functionalities* and *non ICT solutions* are generally considered to be of greater importance. The participants are divided regarding the importance of the categories *process support* and *data / document management*. Considering the participants as cases and looking at their positioning on the SODSC framework suggests that *data management* is considered to be of relevantly higher importance in CC-VNs settings with *stable partnerships*.

6 Conclusions

This chapter separately discusses the two research objectives of this master thesis followed by the limitation of this study. The first research objective was aimed at the development and validation of the KTI framework. This first objective provided a basis for the *second research objective*, as the second objective required a framework with a spectrum of possible KTIs that can occur in CC-VNs. The *second research objective* was to develop and test a process for achieving BIA in CC-VNs with regards to KTIs.

6.1 The first research objective

The *first research objective* was aimed at developing and validating the KTI framework. This objective was divided in two stages, development and validation. The development stage produced the KTI classification framework and the validation stage produced the KTI framework.

The KTI classification framework was methodologically developed through conducting a SLR on literature in related fields. The data on KTIs that was obtained through the SLR had to be synthesized. Possible methodologies which could be applied for this have been reviewed. Through this review the Metaplan method was selected, which is a technique that provides a structured classification process through group meetings. The SLR provided an answer to RQ1.0, the review to RQ1.1 and through conducting three Metaplan sessions a comprehensive KTI classification framework has been developed, consisting out of 6 main categories and 29 KTIs (*research output 1*).

Because the literature that was used to develop the KTI classification framework did not contain literature on KTIs in CC-VNs it was necessary to answer RQ2.0: *Which KTIs occur in CC-VNs*? I.e. validation of the KTI classification framework. This question has been answered with the results of a multiples case study. Eight CC-VNs (cases) were studied until data saturation was reached. The CC-VNs were studied through conducting semi-structured interviews with an expert from each CC-VN. The KTI classification framework provided structure to the interviews and triggered the experts to provide examples of KTIs. The experts were also asked to draw their CC-VN, this provided context information and made it possible to map the CC-VNs of the experts on the SODSC framework. This confirms that the cases that have been studied are different from supply chains. The eight experts provided *strong* examples and importance indications for 28 of the 29 KTIs of the KTI classification framework, which made it possible to answer RQ 2.0 and 2.1. The KTI '*Lack of communication facilities*' was not validated, this invalidation was supported by the discovery of a new KTI namely: '*Too many communication channels*'. The resulting KTI framework (*research output 2*) consists out of 29 KTIs which have been validated in CC-VNs.

To assess how the KTI framework adds to existing literature it was compared to related frameworks (answering RQ 2.2). This comparison shows that the KTI framework is more comprehensive than existing frameworks. One of the main reasons for this is that the KTI framework includes both KTIs related to tacit knowledge and explicit knowledge.

6.2 The second research objective

The *second research objective* was aimed at developing and testing a process for achieving BIA in CC-VNs with regards to KTIs. Through completing the *first research objective* a foundation was available from which the *second research objective* could be completed. The process for achieving BIA in CC-VNs employs a two round Delphi study, aimed at discovering ICT functionalities which can help solving KTI.

To test the process a two round Delphi study was done with the experts from the eight cases. In this Delphi study ICT functionalities were discovered for the ten most relevant KTI. In the Delphi study, semi-structured interviews were used to collect data from experts. During the first round the experts mentioned 120 ICT functionalities. In round two the experts gave importance indications for the

suggested ICT functionalities of round one. They also suggested additional functionalities, after being trigged by the feedback from round one. This meant the collection of ICT functionalities diverted rather than converted, which benefits the generalizability of the findings. Through the Delphi study a total of 131 solutions were collected. These were structured into functionality types though a Metaplan session. The result was a collection of 21 ICT functionality types which have been divided over six categories (*producing research output 3*). These functionality types have been linked to KTIs through the importance indications provided by experts. This makes it possible to determine which ICT functionality types can be employed to solve/prevent KTIs. The results have been strengthened through asking the experts to reflect on the process at the end of the second Delphi round. Their statements, in combination with the result itself, confirm that the process developed in this thesis is effective for achieving BIA in CC-VNs.

6.3 Limitations

It is important to realize that KTIs are serious issues which can negatively affect the performance of a CC-VN. Therefore it is important to consider all possible solutions that can be used against them. The scope of this study is limited in the sense that it was aimed at the discovery of possible ICT solutions. It is also important to consider alternative solution types such as solutions that touch social aspects or agreements, procedures and arrangements.

The generalizability of this study has been discussed in sections 3.5 and 3.7. However, the following limitations should be taken into consideration:

- This study was of a qualitative nature. This means that the indications of importance shown throughout this study might not be applicable to every CC-VN. This can also be observed through how divided the experts in this study were on how important they considered KTIs and ICT functionalities.
- In this research only Dutch experts in CC-VNs have been studied. Therefore it unknown if particular KTIs are less/more important in other CC-VNs located in other countries with different cultural characteristics.

6.4 Future research

The results of this research could be strengthened through triangulation. Future research can be aimed at studying the KTIs that the partners experience within the CC-VNs, which have been studied in this research. This research could also be replicated in countries with different cultural characteristics, to see how culture influences the KTIs that are experienced.

This study was of a qualitative nature, more reliable indications of how important certain KTIs are for CC-VNs, could be achieved through a quantitative study. This opportunity could also be used to establish the risk of KTIs, through identifying the frequency in which they occur and the impact they have when they occur. Additionally these quantitative studies could test the following hypotheses that emerged from the data obtained from the multiple case study:

- CC-VNs that can be characterized as having *stable partnerships* in the SODSC framework are less effected by *Language / understanding issues*.
- CC-VNs with a more collaboratively oriented attitude are less effected by *Social issues*.

Future research could also be aimed at studying the relations between KTIs. Can one KTI be caused by another? Can a particular KTI cause other KTIs? These are relevant concepts because they can facilitate solving, de-escalating and preventing KTIs. For similar purposes future research should also be aimed at identifying other possible solution types for KTIs, such as solutions related to social aspects, agreements or procedures.

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Appendix A: Selection of a classification method.

> **RQ 1.1**: What is a suitable and feasible method for classifying KTIs from existing literature?

The question that is answered in this appendix is: *what is a suitable and feasible method for classifying KTI issues from existing literature?* This is one of the sub questions of the *first research objective* (developing the KTI classification framework). Within the research group there existed a preference for using the Metaplan method. This is due to positive experiences in the past, when applying it in other research (Bagheri, Kusters, & Trienekens, 2015) (Janssens, Kusters, & Heemstra, 2008). But before applying the Metaplan method for this thesis, alternative methods have been given serious consideration. Ensuring that selection of the Metaplan method is an appropriate choice.

This section is structured as follows:

- a list of criteria is presented to which possible classification methods can be subjected,
- a concise summary of all examined methods is given,
- a table is presented that gives an overview of how the methods score on the criteria,
- a conclusion stating why the Metaplan method is selected.

Methodology

To allow for a comparison of classification methods, a list of criteria has been composed in consultation with the research group. The method:
- Has to be suitable for classifying issues into non-predetermined categories with other similar issues.
- Has to be suitable for classifying a set of several hundred unclassified issues.[1]
- Does not have to rank the issues. (I.e. most- common, impact, frequent etc.).
- Has to be executable with the resources available.
- Has to be time efficient.
- Has to eliminate bias.
- Has to be Valid
- Has to be Reliable

Classification methods were subjected to this list of criteria.

Considered classification methods

The methods that were considered were selected in various ways: through recommendations, other studies that have classified issues or through examining the references in papers that mentioned classification methods. Once a method had been selected it was scored on the criteria. The possible score values that were used were: -, 0, +. A rough scale was used due to of the subjective nature of the scoring.

Classification method selection results

A concise description of every considered method is given, followed by a table that gives an overview of how each method scores on the predefined criteria.

Paired comparisons

The Paired comparison method is a method in which a group of judges compares an item of a set against all other items in the set. Meaning that if a judge does a particular paired comparison only once, the

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[1]A quick scan of the literature found by the SLR showed that there would be several hundred issues, rather than tens or thousands.

judge has to do ½*n*(n-1) trials in total, where n represents the number of items in the set (David, 1963). David (1963) states that this method is used primarily for determining which one of two items is preferable. Suggesting it is not optimal for clustering items. According to David (1963) the method is also more appropriate when fine judgment is required between all items. Silverstein & Farrell (2001) present a more efficient method for doing paired comparisons where subsets of items are compared opposed to the whole set of items. However, if judges disagree over a particular comparison, the disagreement has to be resolved.

Fuzzy sets

Other studies aimed at identifying issues (Wahlström, 2011) have used fuzzy set theory (Klir, St Clair, & Yuan, 1997) to group issues into clusters, enabling the identification of 'the most common' issues. To use fuzzy set theory, issues have to be coded with respect to their perceived membership in predefined categories. Doing this with several people and combining the coding can eliminate individual bias. Cluster solutions can then be found by examining the sum of distances to cluster centers from M to M-1 clusters, where a large increase indicates a feasible solution (Wahlström, 2011).

Content analysis

Chelimsky (1989) describes a method called content analysis, which gives a standardized format for collecting and organizing written material. The method describes six steps: *formulate a objective question, select material, select a recording unit, develop categories, code material and interpret the results* (Chelimsky, 1989). Although the paper presents a sensible procedure it does not detail the step of *coding the material*: "Material can be coded either manually or by computers, depending on the resources available and the format of the material" (Chelimsky, March 1989). This description makes it impossible to propperly apply the criterea to this method.

Metaplan

A structured meeting with the research group could be held to classify the issues. A method for this is Metaplan. "Metaplan was developed in the early 1970s by several researchers (Cloyd, et. al., 1975) as an answer to the problem of poor meetings" (Howard M. S., 1994). Conducting a Metaplan session requires some basic office supplies and a minimum of four people (Habershon, 1993). During the sessions cards will be used with issues written on them. "Clusters are formed by group members grouping similar concepts together. For the first few cards, there are no clusters; the cards stand alone comprising their own cluster. Then, as more and more cards are sorted, clusters start to form" (Howard M. S., 1994).

Modified-Delphi

A method that also uses card sorting is called modified-Delphi.

The Modified-Delphi card sort can be summarized in the following four steps:

1. The seed participant creates the initial structure from a stack of cards and proposes an information structure model.
2. The following participants comment on the previous participant's model and make modifications to the proposed model or propose a new model.
3. The card structure changes throughout the study, evolving into a model that incorporates input from all of the participants.
4. A consensus is reached when the information structure stabilizes and there are no more significant changes or obvious patterns of conflict and agreement arise. (Paul, 2008)

Traditional Delphi studies typically require eight to ten participants, and a moderator (to avoid conflict of interest a third-party moderator may be used) (Paul, 2008).

Overview of the classification methods

Table 10 gives an overview of how the classification methods score on the criteria dicussed at the beginning of this appendix. The possible score values are: -, 0, and +. A relatively rough scale is used because of the subjective nature of the scoring. A rationale for the scoring is given in the next section.

This appendix gives an argumentation for why a certain score was assigned to a criterion for a classification method.

Method	Suitability	Appropriate for issue amount	Does not rank issues	Time efficient	Resource efficient	validity	reliability
Paired comparison	-	-	-	-	0	-	+
Fuzzy sets	-	+	+	-	+	+	+
Content analysis	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Metaplan	+	+	+	+	+	+	+
Modified-Delphi	+	+	+	0	-	+	+

Table 10 Overview of classification method scorings

Scoring rationales

This section presents reasoning for the scorings of Table 10.

- Paired comparison: Suitability(-): The method compares two items to see which one is preferred, it is not designed for clustering.
- Paired comparison: Appropriate for issue amount(-): The amount of time required increases exponentially with the amount of items to be processed. Making the method more appropriate for ranking a set containing between 2 and 20 items.
- Paired comparison: Does not rank issues(-): The method ranks issues.
- Paired comparison: Time efficient(-): The amount of time required increases exponentially with the amount of items to be processed. The judges who rank would also have to discuss every item on which they disagree. Meaning there would be work done individually and in a group.
- Paired comparison: Resource efficient(0): The method could be done with the research group but for such a large set of items more judges would be preferable. So that some disagreements discussions can be avoided due to an obvious majority for a particular ruling.
- Paired comparison: Validity(-): The method is not suitable for clustering.
- Paired comparison: Reliability(+): The method is quite thorough, comparing every item against every other item. Repeating the ranking with judges that have similar backgrounds is expected to yield the same results.

- Fuzzy sets: Suitability(-): The method requires predefined categories which are not available.
- Fuzzy sets: Appropriate for issue amount(+): Once scores are entered for to what degree an item belongs in a category the remaining work can supported by software.
- Fuzzy sets: Does not rank issues(+): The method is designed for clustering.
- Fuzzy sets: Time efficient(-): The entering of the scores for the degree to which an item belongs in a category can be very time consuming. Judges also have to discuss items on which they strongly disagree. After the ranking there is also some time required to get familiar with the software that supports the clustering.
- Fuzzy sets: Resource efficient(+): The method can be executed by the research group.
- Fuzzy sets: Validity(+): The method is designed for clustering. The only drawback in for this thesis is that it required predetermined categories.
- Fuzzy sets: Reliability(+): Repeating the scoring with judges that have similar backgrounds is expected to yield the same results. Especially because small disagreements should not have a major impact regarding in which cluster an issue is placed.

Content analysis: Suitability(n.a.), Appropriate for issue amount(n.a.), Does not rank issues(n.a.), Time efficient(n.a.), Resource efficient(n.a.), Validity(n.a.), Reliability(n.a.): The method does not specify if coding is done manually or computer supported. It also does not indicate how many resources are required and what kind of tasks should be performed.

- Metaplan: Suitability(+): The method is suitable for placing items in clusters.
- Metaplan: Appropriate for issue amount(+): The method is suitable for processing several hundred items.
- Metaplan: Does not rank issues(+): The method does not rank issues.
- Metaplan: Time efficient(+): Because the people involved do all of the clustering in a group there is no time is spend on clustering individually. Items are only placed in a category if there is consensus for placing that item in a particular category.
- Metaplan: Resource efficient(+): The method can be executed by the research group.
- Metaplan: Validity(+): The method is suitable for clustering. If the judges are familiar with the items that have to be clustered the resulting clusters are well reasoned.
- Metaplan: Reliability(+): Repeating the scoring with judges that have similar backgrounds is expected to yield very similar results. The only difference that is likely to occur is the abstraction level chosen. Some clusters can be divided into more specific clusters, other cluster could possibly be merged.

Modified-Delphi: Suitability(+): The method is suitable for placing items in clusters.
- Modified-Delphi: Appropriate for issue amount(+): The method is suitable for processing several hundred items.
- Modified-Delphi: Does not rank issues(+): The method does not rank issues.
- Modified-Delphi: Time efficient(0): The time spend per resource should be similar to the Metaplan sessions. However because more resources are required the total time of applying this method is substantially larger. Especially because one resource, the moderator, has the task of combining the results. A task that the Metaplan sessions do not require.
- Modified-Delphi: Resource efficient(-): The method is recommended to be executed with a minimum of 8 judges and an independent moderator. These resources are not available to the research group.
- Modified-Delphi: Validity(+): If the judges are familiar with the items that have to be clustered the resulting clusters are well reasoned.
- Modified-Delphi: Reliability(+): Repeating the scoring with judges that have similar backgrounds is expected to yield the very similar results. The only difference that is likely to occur is the abstraction level chosen. Some clusters can be divided into more specific clusters, other cluster could possibly be merged.

Appendix B: Metaplan

The Metaplan method is a card sorting method where, during a structured meeting, cards are sorted into clusters. The Metaplan session cards where made from the findings of the SLR; containing: a reference to the author, the issue as described in the source and an explanation of the issue as described in the source. The explanation was added to the card to reduce the multi-interpretability of issues, making it easier to place issues in clusters. The reference to the author was included for cases where the card did not contain enough information to place it into a cluster and the source had to be consulted. The cards were also divided in two groups, tacit issues and explicit issues, to make the initial placement easier.

The Metaplan sessions have been conducted with the research group. A total of three sessions have been done. This is due to the amount of time it took to get a satisfactory set of clusters. During the first session, cards containing tacit issues and cards containing explicit issues were kept and sorted separately. This was done to make the initial clustering easier, as the issues of the same information type are more related to each other. Cards were drawn from a container and placed in a new or existing cluster on tables. First the tacit issues were drawn by R. Kusters, the explicit issues were drawn by H.V.N. van der Zandt. This was done to reduce the *bandwagon effect*. After drawing a card, the group placed it in a new or existing cluster. During the first session some cards were removed for various reasons, this is documented in the session-tables. Between the clustering of the tacit issues and the explicit issues there was a break. At the end of the first and second half, pictures were taken of how the cards were placed on the tables. After the session the clusters were digitalized in tables of issues similar to the tables of the final clusters.

The second session was a continuation of the first session, starting with cards that were placed in a tacit or explicit cluster, which was also given a name. During the sessions some clusters were merged. Some clusters of one category were divided over more specific clusters of the other category and some clusters remained unchanged. Changes of issues and clusters have been documented in session-tables. At the end of the session, pictures were taken of how the cards were sorted.

The third session started with the clusters of the second session, with a definition added to each cluster to clarify what kind of issues the cluster contains. During the third session no changes were made to the amount of clusters. However, a small number of issues were rearranged and the definitions that were added to clusters were discussed by the research group and revised were necessary. The names of the clusters received similar treatment. Finally the clusters were grouped together into general-categories. All of the changes made during the session were written on the cards, including the general-category in which a cluster was placed. During the third session only a couple of issues were moved from one cluster to another. Because the set of clusters stabilized, as is shown in Figure 12, no additional Metaplan sessions were held. However, during a later meeting some clusters definitions were further improved. A total of 269 issues have been classified by the research group by applying the Metaplan method, 152 tacit & 117 explicit.
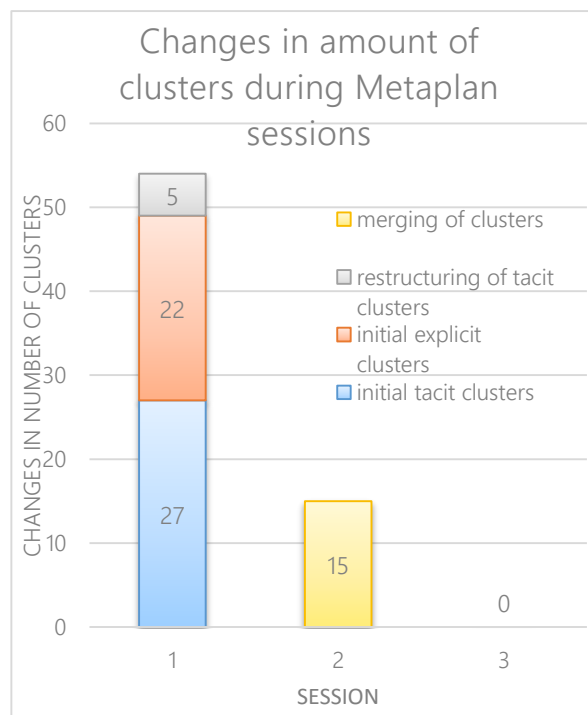
Figure 12 Changes in amount of clusters during Metaplan sessions

Session tables

Table 11, Table 12, Table 13 and Table 14 are referred to as sessions tables, these tables show the clusters that existed at the end of a session. Additionally Table 11, Table 12, Table 13 (which are the results of the first session) show what happened to these clusters during the next session. Table 15 to Table 43 present the 29 resulting clusters. Every table shows the issues that the cluster contains, the source of the issue and the 'Categorization path' that each issue travelled during the Metaplan sessions.

Index	Description	Moved to
o1	Lack of funds for KM system development	Absorbed by tA
o2	Management's failure to motivate employees	Became tB
o3	Lack of top management commitment to adopt KM in SC	Absorbed by tA
o4	Organizational issues and management errors	Became tC and absorbed by tA
o5	Equal access for all communication participants	Absorbed by tE
o6	Inflexibility of management	Became tD
o7	Organizational technological issues	Became tG and absorbed by tE
o8	Network technological issues	Became tF
o9	Bad relationships at people level	Became tM & tN
o10	Knowledge is power	Absorbed by tR
o11	(Fear of) incompetence of knowledge receiver	Absorbed by tI and tR
o12	Lack of retentive capacity	Became tI
o13	Fear of losing knowledge to competitors	Became tJ and absorbed by tR
o14	Don't trust the correctness of information from a source	Became tH
o15	Trust issues	Became tK and absorbed by tR
o16	Transparency issues	Absorbed tE and
o17	Cultural issues	Became tL
o18	Different ways of looking at/naming things across a network	Absorbed by tP & tL & tI and became tO & tQ
o19	Social capital issue	Absorbed by tL
o20	Norm distance issues	Absorbed by tP and tQ
o21	Network communication issues regarding KM	Became tU
o22	Sharing of non-beneficial knowledge (bad habits)	Absorbed by tU
o23	Lack of awareness of others knowledge	Became tT
o24	Failure to create a transitive memory	Became tV
o25	Not invented here syndrome	Absorbed by tR
o26	Conflict avoidance	Absorbed by tS
o27	Unwillingness of an organization to find new partners	Absorbed by tS
Removed	No communication,	Too generic
Removed	Difficulties to receive or transfer knowledge from and to others	Too generic
Removed	Communication skills,	Is a solution, not an issue placed in cluster O, organizational issues

Table 11 initial tacit issue clusters

Index	description	Morphing
tA	Organizational issues and management errors	Absorbed by 16(1) & 18(1) & 19(5) & 20(7)
tB	Management's failure to motivate employees	Became 14
tC	Lack of places to share	Became 10
tD	Top management issues	Absorbed by 18(1) & 20(2) & 21(3)
tE	General IT issues	Absorbed by 23(1) & 24(3) & 25(2)
tF	Technical issues	Absorbed by 23(2) & 24(4)
tG	Data security	Became 28
tH	Knowledge source not perceived as reliable	Became 7
tI	Lack of absorptive capacity	Absorbed by 8
tJ	Fear of losing knowledge to competitors	Became 15
tK	Trust issues	Absorbed by 13(*)
tL	Collaboration issues due to culture	Became 5
tM	Physical distance, lack of face-to-face	Became 4
tN	Difficult relationships	Became 2
tO	Difficulties making tacit knowledge explicit	Became 6
tP	Semantic issues, different terminology/ perceptions	Became 11
tQ	Loss of context	Became 12 and absorbed by 8(1)
tR	Lack of willingness to share knowledge	Became 16
tS	Resistance to change	Absorbed by 16(*)
tT	Lack of knowledge awareness	Became 8
tU	Process related issues	Became 20
tV	Transitive memory issues	Became 1
Removed	Transparency (*not an issue*)	
Removed	Poor community skills *(unclear meaning)*	
Removed	Effective communication *(too generic)*	
Removed	Poor physical work environment *(too generic)*	

Table 12 rearranged tacit issue clusters

Index	Description	morphing
eA	Network level objective / benefit issues	Became 29
eB	Data overload issues	Became 17
eC	Trust issue	Absorbed by 13(*)
eD	Legal issue	Became 9
eE	Confidentiality issue/ losing property data	Absorbed by 15(*)
eF	Bureaucracy issue	Absorbed by 21(*)
eG	Insufficient resource	Became 19
eH	Process-related issue	Became 22 and absorbed by20(1)& 23(1) & 24(1)
eI	Lack of top management commitment	Became 18
eJ	Accessibility, data flow issue	Became 25 and Absorbed by 24(1)
eK	Lack of incentive	Absorbed by 14(*)
eL	Lack of autonomy	Absorbed by 21(*)
eM	Data quality issues	Became 27 and Absorbed by 11(1) & 28(3)
eN	Data- related issues(??) / heterogeneous IS	Absorbed by 20(4) & 27(1)
eO	Complex network issues	Became 3
eP	Lack of user-friendly IS	Became 26
eQ	IS-related data exchange issue	Became 24
eR	Technological issues	Became 23
eS	Contextual issues	Absorbed by 12(*)
eT	Lack of willingness	Absorbed by 16(*)
eU	Ownership	Absorbed by 15(*)
eV	Lack of common knowledge	Absorbed by 8(*)
Removed	Interpreting the meaning of silence *(out of scope)*	moved to cluster M, contextualization issues
Removed	Lack of repeatability *(out of scope)*	

Table 13 explicit issue clusters

Index	Description
1	Transactive memory issues
2	Relationship issues
3	Complex network issues
4	General distance/physical distance
5	Cultural distance
6	Difficulty in expressing tacit knowledge
7	Knowledge source reliability issues (incorrect data)
8	Insufficient mutual understanding
9	Legal issues
10	Lack of communication facilities
11	Semantic issues
12	Contextualization issues
13	Lack of trust
14	Lack of incentive
15	Fear of losing knowledge
16	Lack of willingness
17	Data overload issues
18	Lack of top management commitment
19	Insufficient resources
20	Organizational issues
21	Organizational structure issues
22	Performance measurement issues
23	Failure to meet technological demand
24	Data integration issues
25	Accessibility, data flow issue
26	Lack of user-friendly information systems
27	Data quality issues
28	Data security issues
29	Network level objective / benefit issues

Table 14 Output of the second Metaplan session where tacit and explicit issues were merged

Resulting classification

This section presents the clusters that resulted from the Metaplan sessions. Each KTI is given an ID that is used throughout this thesis document.

Network structure issues

A	Transactive memory issues	
Source	issue	Categorization path
33	Different locations of knowledge	o24 > tV >1 > A
43	Failure to develop a transactive memory system	o24 > tV >1 > A
1	Constraints on transactive memory	o24 > tV >1 > A

Table 15 Transactive memory issues

A. Transactive memory issues:
Refers to the set of knowledge possessed by group members coupled with an awareness of who knows what.

B	Relationship issues	
Source	issue	Categorization path
30	Arduous relationship	o9 > tN > 2 > B
7	power issues	o9 > tN > 2 > B
15	status differences, lack of respect	o9 > tN > 2 > B
25	Difficult relationships	o9 > tN > 2 > B
25	Excessive size of business units	o9 > tN > 2 > B
6	Knowledge distance	o9 > tN > 2 > B
36	Age distance. Gender distance	o9 > tM > 4 > B

Table 16 Relationship issues

B. Relationship issues: Collaborations between actors are hindered because of personal relationships. One firm feels superior over the other.

C	Complex network issues	
Source	issue	Categorization path
16	Fragmented networks	eO > 3 > C

Table 17 Complex network issues

C. Complex network issues: Extreme complexity in terms of relationships, communications, and use of knowledge.

D	General distance issues	
Source	issue	Categorization path
34	Temporal distance or time zone difference	o9 > tM > 4 > D
34	Geographic distance	o9 > tM > 4 > D
43	Teams that have not met face-to-face and do not feel like a ''real'' team	o9 > tM > 4 > D
43	The lack of comfort and trust made it difficult to build team rapport across virtual space.	o9 > tM > 4 > D
13	Geographical Distance	o9 > tM > 4 > D

Table 18 General distance issues

D. General distance issues: Physical or time distance between actors creates difficulties in knowledge sharing.

E	Cultural distance issues	
Source	issue	Categorization path
8	Lack of common ground	o17 > tL >5 > E
4	culture	o17 > tL >5 > E
6	Lack of cultural awareness	o17 > tL >5 > E
17	Social capital issue	o19 > tL >5 > E
25	Context differences	o18 > tL >5 > E
34	Linguistic distance	o17 > tL >5 > E
37	cognitive distance (different backgrounds)	o17 > tL >5 > E
43	Cultural constraints on knowledge sharing	o17 > tL >5 > E
13	*-added after the sessions- (language)*	

Table 19 Cultural distance issues

E. Cultural distance issues: All actors must know each other's respective cultural backgrounds. Views and ideas can be negatively influenced by not knowing languages people speak, their habits, and what is acceptable and what is not.

F	Lack of communication facilities	
Source	issue	Categorization path
37	Lack of opportunities for communication/collaboration	o4 > tC > 10 > F
35	Shortage of formal and informal spaces to share, reflect and generate knowledge	o4 > tC > 10 > F
25	Lack of spaces to share	o4 > tC > 10 > F
25	Lack of tangible mechanisms	o4 > tC > 10 > F
25	Lack of intangible mechanisms: unscheduled meetings, informal seminars, or conversations	o4 > tC > 10 > F

Table 20 Lack of communication facilities

F. Lack of communication facilities: Lack of opportunities for communication and lack of formal/informal mechanisms, making it difficult to transfer knowledge across a network.

Generic issues

G	Difficulty in expressing tacit knowledge	
Source	issue	Categorization path
35	Difficulty in codifying tacit knowledge	o18 > tO > 6 > G
15	cognitive barrier	o18 > tO > 6 > G

Table 21 Difficulty in expressing tacit knowledge

G. Difficulty in expressing tacit knowledge: People are unable to externalize/codify their tacit knowledge.

Social issues

H	Knowledge source reliability issues	
Source	issue	Categorization path
30	Info not perceived as reliable	o14 > tH >7 > H
30	Unproven (Is knowledge rated as being of value?)	o14 > tH >7 > H
33	Knowledge retainer's legitimacy and reliability	o14 > tH >7 > H

Table 22 Knowledge source reliability issues

H. Knowledge source reliability issues: Knowledge is not perceived as true because its source is unreliable.

I		Fear of losing knowledge	
Source	issue		Categorization path
25	Fear of losing intellectual property rights		o13 > tJ > 15 > I
25	Lack of coordination between units: Competitiveness		o13 > tJ > 15 > I
17	Knowledge Ownership		o13 > tJ > 15 > I
17	Loss of sensitive and proprietary knowledge		o13 > tJ > 15 > I
30	Risk (including fear of penalty, losing profit)		o13 > tJ > 15 > I
41	ownership		eU > 15 > I
20	fear of losing company stability/market position		eE > 15 > I
47	Confidentiality, commercial privacy and economic value of information		eE > 15 > I
47	Cost of disclosing information		eE > 15 > I
50	commercial sensitivity of data and the privacy risks involved		eE > 15 > I

Table 23 Fear of losing knowledge

I. Fear of losing knowledge: Since knowledge is a source of competitive advantage, there is fear that when it is shared, it is shared with partners that could be competitors.

J		Lack of willingness	
Source	issue		Categorization path
30	Fear of exploitation		o10 > tR > 16 > J
30	Self-interest (expose knowledge to competition)		o10 > tR > 16 > J
30	Lack of motivation (not invented here syndrome)		o10 > tR > 16 > J
30	Internal resistance (protect interests of organization/business unit)		o10 > tR > 16 > J
30	Fear of contamination		o11 > tR > 16 > J
30	Fear of undermining position		o13 > tR > 16 > J
30	Knowledge system modification		o4 > tA > 16 > J
25	Technophobia		o10 > tR > 16 > J
25	Low awareness and realization of knowledge sharing		o13 > tR > 16 > J
25	Lack of trust in people		o15 > tR > 16 > J
25	Threat to sense of self-worth		o13 > tR > 16 > J
25	Fear of reducing job security		o13 > tR > 16 > J
25	Not Invented Here (NIH) syndrome		o25 > tR > 16 > J
35	Communication and knowledge flows are restricted into certain directions of SC		o10 > tR > 16 > J
35	Fear of embarrassment for sharing incorrect information		o13 > tR > 16 > J
37	Unacceptable behavior of technical system by user		o25 > tR > 16 > J
37	Different preferences in working/learning		o13 > tR > 16 > J
37	Existing relationships preferred		o27 > tS > 16 > J
37	Not learning from the past		o27 > tS > 16 > J
52	genuineness		o13 > tR > 16 > J
52	Lack of openness to ideas		o25 > tR > 16 > J
13	Internal resistance		o25 > tR > 16 > J
13	Conflict avoidance		o26 > Ts > 16 > J
48	Knowledge stickiness		o10 > tR > 16 > J
32	Willingness		o10 > tR > 16 > J
22	differences in interests, existing practices, goals,		o13 > tR > 16 > J
22	A solution that requires a change of views is difficult to accept for some people		o25 > tR > 16 > J
7	Risk taking		o26 > tS > 16 > J

54	Lack of flexibility to change	o26 > tS > 16 > J
4	maturation	o26 > tS > 16 > J
20	Employees are not willing to share the information.	eT >16 > J
20	Attitudes of the organizations towards the implementation of information sharing.	eT >16 > J
20	Behavioral issues	eT >16 > J
20	Lack of harmonious environment	eT >16 > J
53	information sharing is not part of an organization's culture	eT >16 > J
53	The perception that information is power	eT >16 > J
38	Individual and organization resistance to change	eT >16 > J
36	*-Added after the sessions-* (articulability, projectionism.)	

Table 24 Lack of willingness

J. Lack of willingness: People don't want or are unmotivated to engage in knowledge sharing for reasons including knowledge as a power syndrome, lack of trust in people, resistance to change, or fear of exploitation.

K	Lack of trust	
Source	issue	Categorization path
54	Lack of mutual understanding/trust between organizations	o15 > tK > 13 > J
54	Negative experiences of past behaviors	o15 > tK > 13 > J
32	Trustworthiness	o15 > tK > 13 > J
21	Rapport	o15 > tK > 13 > J
35	Opportunistic behavior of SC members	o15 > tK > 13 > J
4	Trust	o15 > tK > 13 > J
47	Data ownership and conflict of disclosure policy	eC > 13 > J
53	Lack of trust among organizational members	eC > 13 > J
16	trust is difficult to build in the context of projects	eC > 13 > J
14	Competitive conflict	eC > 13 > J
38	Lack of trust and confidentiality among organizations	eC > 13 > J
19	the handling of confidential information (trust)	eC > 13 > J

Table 25 Lack of trust

K. Lack of trust: A belief that the other party might act opportunistically or in an unfavorable way hinders knowledge sharing across a network.

Language / understanding issues

L	Insufficient mutual understanding	
Source	issue	Categorization path
42	No Integration of the knowledge into the social system	o12 > tI > 8 > L
9	Value of knowledge	o12 > tI > 8 > L
9	Perception	o23 > tT > 8 > L
25	Differences in experience level	o11 > tI > 8 > L
30	Lack of absorptive capacity	o12 > tI > 8 > L
30	Lack of retentive capacity	o12 > tI > 8 > L
30	Causal ambiguity	o18 > tI > 8 > L
30	Poor targeting of knowledge	o12 > tI > 8 > L
22	Differences in interests	o20 > tQ > 8 > L
53	lack of common knowledge	eV > 8 > L
25	Lack of awareness	o23 > tT > 8 > L

33	Awareness of other knowledge	o23 > tT > 8 > L
13	A gap in Awareness and knowledge	o23 > tT > 8 > L

Table 26 Insufficient mutual understanding

L. Insufficient mutual understanding: Unable to make good use of the others' knowledge due to a lack of common ground, casual ambiguity, difference in perception, or lack of knowledge of exactly how the knowledge is supposed to be used.

M	Contextualization issues	
Source	issue	Categorization path
37	Loss of communication richness	o18 > tQ > 12 > M
5	Knowledge embeddedness	o18 > tQ > 12 > M
28	Lack of contextualization	o18 > tQ > 12 > M)
1	Failure in sharing and retaining contextual knowledge	o18 > tQ > 12 > M
3	Failure to Communicate and Retain Contextual Information.	eS > 12 > M
3	Differences in the Salience of Information	eS > 12 > M
3	Interpreting the meaning of silence	eRemoved > - > M

Table 27 Contextualization issues

M. Contextualization issues: Context can be defined as information about the situation, intentions, and feelings about an issue or action. Losing the context of knowledge can be an issue, especially for tacit knowledge.

N	Semantic issues	
Source	issue	Categorization path
22	Different terminology / jargon	o18 > tP > 11 > N
22	Understanding what is relevant and what is not	o18 > tP > 11 > N
22	Different perceptions of a solution	o18 > tP > 11 > N
22	A different understanding of project goals	o18 > tP > 11 > N
8	Knowledge may not be correctly interpreted or used due to biases in one's reasoning.	o18 > tP > 11 > N
17	Semantic issue	o18 > tP > 11 > N
5	Norm distance	o20 > tP > 11 > N
33	Conflicting knowledge of network members	o18 > tP > 11 > N
25	Overly technical terminology	o18 > tP > 11 > N
1	Insufficient mutual understanding	o18 > tP > 11 > N
2	Misunderstandings and a lack of shared meaning	o18 > tP > 11 > N
44	Lack of shared mental models (an organized understanding of relevant knowledge that is shared by team members')	o18 > tP > 11 > N
20	misinterpretation or misuse of shared information	eM > 11 > N

Table 28 Semantic issues

N. Semantic issues: Use of different terminology or different meanings of words can cause misunderstandings.

Organizational aspect issues

O	Organizational issues	
Source	issue	Categorization path
9	Sharing of invaluable knowledge	o22 > tU > 20 > O
49	Communication problems among network members	o21 > tU > 20 > O
35	Lack of clear understanding of KM adoption n SC	o21 > tU > 20 > O

35	KM not integrated with SC business process	o21 > tU > 20 > O
35	Lack of roles and responsibilities of SC members	o4 > tA > 20 > O
35	Lack of strategic planning regarding KM adoption in SC	o4 > tA > 20 > O
35	Lack of proper organizational structure to create and share knowledge	o4 > tA > 20 > O
35	Lack of empowerment among SC members	o4 > tA > 20 > O
35	Knowledge retention of highly skilled and experienced staff is not a high priority	o6 > tD > 20 > O
25	Lack of complete or standard regulations	o4 > tA > 20 > O
25	Lack of authority	o4 > tA > 20 > O
37	Lack of policy or regulations	o4 > tA > 20 > O
37	Coordination breakdown, challenges or lack of direction	o6 > tD > 20 > O
12	IS strategy and planning	eH > 20 > O
11	lack of delegation of responsibilities for maintenance of data	eN >20 > O
11	Lack of written data quality politics and procedures	eN >20 > O
11	Lack of clarity of roles in relation to data creation, use, and maintenance	eN >20 > O
10	lack of data control routines	eM > 28 > AB > O
38	Lack of common data definitions and standards	eN >20 > O
39	Lack of organization structure	eG > 19 > O
32	Communication skills	oRemoved >->-> O

Table 29 Organizational issues

O. Organizational issues: The organization does not have sufficient formal planning, guidelines or regulations for knowledge sharing. This makes it unclear who is responsible, and what and how data should be shared.

P	Lack of top management commitment	
Source	issue	Categorization path
11	lack of management understanding and active involvement	el > 18 > P
39	The lack of top management commitment	el > 18 > P
43	Lack of management/leadership support for any reflection on how we work together	o6 > tD > 18 > P
35	Lack of top management commitment towards KM adoption in SC	o3 > tA > 18 > P

Table 30 Lack of top management commitment

P. Lack of top management commitment: Due to lack of top management commitment and involvement, knowledge sharing initiatives lack a mandate, causing them to fail.

Q	Network level objective / benefit issues	
Source	issue	Categorization path
19	Unequal division of benefits	eA > 29 > Q
19	Power asymmetry	eA > 29 > Q
38	Goal problems	eA > 29 > Q
20	Information sharing is seen as a financial burden	eA > 29 > Q
53	lack of understanding benefits from cross-boundary information sharing	eA > 29 > Q
44	Varied goals across a network or unclear goals	o21 > tU > 20 > Q

Table 31 Network level objective / benefit issues

Q. Network level objective / benefit issues: Given power asymmetry and goal problems at the network level, actors do not equally benefit from knowledge sharing.

R	Insufficient resources	
Source	issue	Categorization path
47	Limited technical expertise	eG > 19 > R
39	Lack of organization structure	eG > 19 > R
26	Cost of information technology	eG > 19 > R
11	Lack of training and education of data users	eG > 19 > R
38	Project schedule problems	eG > 19 > R
38	Resource problems	eG > 19 > R
20	lack of training	eG > 19 > R
20	Unable to maintain adequate technological expertise due to rapid changes	eG > 19 > R
20	Lack of funds for redesigning internal organizational and technical processes	eG > 19 > R
27	Implementation Cost	eG > 19 > R
25	Time and resource constraints	o4 > tA > 19 > R
25	Lack of training of new IT systems	o4 > tA > 19 > R
25	Lack of time	o4 > tA > 19 > R
25	Employees are unfamiliar with and lack experience with new IT systems	o4 > tA > 19 > R
35	Lack of fund for KM system development	o1 > tA > 19 > R

Table 32 Insufficient resources

R. Insufficient resource: Lack of resources such as expertise, training, time, funds, and network structure cause difficulties for knowledge sharing.

S	Organization structural issues	
Source	issue	Categorization path
16	Contractual culture	eF > 21 > S
38	Organizational hierarchy/structure	eF > 21 > S
20	high level of bureaucracy and strict administrative control	eF > 21 > S
53	Centralization (of authority in higher management levels)	eL > 21 > S
53	Horizontal structures of bureaucracy	eL > 21 > S
20	Too centralized and lack of autonomy	eL > 21 > S
54	Top management directives stifle inter-organizational learning	o6 > tD > 18 > S
7618	organizational bureaucratic factors	o6 > tD >18 > S
25	Unrealistic expectations of employees and mismatch with individual needs	o6 > tD >21 > S

Table 33 Organization structural issues

S. Organization structural issues: Inflexibility results from excessive hierarchy and centralization, or too many guidelines and regulations. People may be willing to share, but lack the authorization.

T	Lack of incentive	
Source	issue	Categorization path
30	Rewards (individuals rewarded for sharing/creating knowledge)	o2 > tB > 14 > T
25	Not adequately rewarded	o2 > tB > 14 > T
25	Lack of organizational incentives	o2 > tB > 14 > T
25	Lack of communication with employees about the advantages of the	o2 > tB > 14 > T

	new system	
11	lack of rewards for ensuring valid data	eK > 14 > T

Table 34 Lack of incentive

T. Lack of incentive: People are not motivated to share their knowledge due to a lack of incentives in the form of accolades or rewards.

U	Authorization / data flow	
Source	issue	Categorization path
27	Accessibility	eJ > 25 > U
20	Differences in level of the technological capabilities of chain members	eJ > 25 > U
39	lack of information flow	eJ > 25 > U
12	Information flow from customer and sales	eJ > 25 > U
38	No sharing guidelines	eJ > 25 > U
38	Information asymmetric	eJ > 25 > U
3	Unevenly Distributed Information	eJ > 25 > U
3	Relative Differences in Speed of Access to Information	eJ > 25 > U
42	No Transparency	o16 > tE > 25 > U
52	Equal access for all communication participants	o5 > tE > 25 > U

Table 35 Authorization / data flow

U. Authorization / data flow: Data exists but is not mobile. People cannot access it and therefore they cannot derive value out of it.

V	Performance measurement issues	
Source	issue	Categorization path
12	Monitoring control and costing	eH > 22 > V
38	Lack of measurement and evaluation	eH > 22 > V
19	lack of cost-sharing agreements	eH > 22 > V

Table 36 Performance measurement issues

V. Performance measurement issues: Without monitoring control and evaluation procedures it is impossible to tell how KM system is performing.

W	Legal issues	
Source	issue	Categorization path
53	lack of legislative support to assure the privacy and confidentiality of shared information	eD > 9 > W
53	laws and regulations	eD > 9 > W
50	risk of privacy infringement	eD > 9 > W
50	data protection legislation	eD > 9 > W
37	Unclear IPR and Copyrights	W

Table 37 Legal issues

W. Legal issue: Laws and regulations may put constrains on inter-organizational knowledge sharing.

Technical issues

X	Failure to meet technological demand	
Source	issue	Categorization path
12	Information storage	eR > 23 > X
12	Functionality of IS	eR > 23 > X

12	Bespoke office applications	eR > 23 > X
12	the use and maintenance of the IS	eR > 23 > X
12	Implementation and customization of IS	eR > 23 > X
11	Lack of IT systems for data management	eR > 23 > X
11	Lack of possibilities for input in existing IT systems	eR > 23 > X
38	Lack of telecommunication network	eR > 23 > X
38	System security	eR > 23 > X
38	Lack of enterprise IT-architecture	eR > 23 > X
27	Information Systems functionality	eR > 23 > X
27	information systems use and maintenance	eR > 23 > X
27	Notification Process	eH > 23 > X
26	Reliability of information technology	eR > 23 > X
47	Limited access to communication technology	eR > 23 > X
37	Availability Shortage of appropriate infrastructure supporting sharing knowledge and practices	o7 > tE > 23 > X
35	Lack of technological infrastructure to adopt KM in SC	o8 > tF >23 > X
30	Available technology (Does IT support knowledge requirement)	o8 > tF >23 > X

Table 38 Failure to meet technological demand

X. Failure to meet technological demand: Technology in place is inadequate (e.g. lack of functionality, architectural issues, system security) to support a network's actual knowledge transfer process.

Y	Lack of user-friendly IS	
Source	issue	Categorization path
53	Lack of user-friendly IT applications	eP > 26 > Y
11	lack of user-friendliness of the software used to manage data	eP > 26 > Y
41	Issue associated with data view	eP > 26 > Y
41	Issues associated with the presentation of data	eP > 26 > Y

Table 39 Lack of user-friendly IS

Y. Lack of user-friendly IS: The system is not adequately user friendly.

Z	Data quality issues	
Source	issue	Categorization path
27	information availability	eM > 27 > AB
27	Information Consistency issues	eM > 27 > AB
12	Information availability and accessibility	eM > 27 > AB
12	Information completeness and accuracy	eM > 27 > AB
12	Information currency	eM > 27 > AB
19	the lack of information quality,	eM > 27 > AB
41	Issues associated with data values	eM > 27 > AB
53	Concern about information privacy	eN > 27 > Z

Table 40 Data quality issues

Z. Data quality issues: Refers to availability, privacy, accessibility, accuracy, and completeness of shared data.

AA	Data overload issues	
Source	issue	Categorization path
20	Information overload	eB > 17 > AA
11	Too much data	eB > 17 > AA

Table 41 Data overload issues

AA. Data overload issues: There is more data available than that there is processing capacity available.

AB	Data security issues	
Source	issue	Categorization path
35	Low data and information security within SC	o7 > tG > 28 > AB
25	Lack of trust in system (security)	o7 > tG > 28 > AB
37	Reliability and security of information exchange	o7 > tG > 28 > AB
27	Data security issues	eM > 28 > AB
47	Ensuring data quality, integrity and security	eM > 28 > AB

Table 42 Data security issues

AB Data security issues: Technological issues generate reliability and security concerns in knowledge transfer.

AC	Data integration issues	
Source	issue	Categorization path
27	Interoperability Issues	eQ > 24 > AC
27	use of email as a way of sharing information	eQ > 24 > AC
53	heterogeneous information systems	eQ > 24 > AC
53	Information system outsourcing	eQ > 24 > AC
38	Incompatible hardware and software	eQ > 24 > AC
14	Adherence to standards	eQ > 24 > AC
14	Network complexity	eQ > 24 > AC
12	Paper-based systems	eQ > 24 > AC
12	Manual systems and data entry	eQ > 24 > AC
12	Information identification, location and organization	eQ > 24 > AC
12	Issues concerning information exchange	eQ > 24 > AC
39	lack of integration guidelines	eQ > 24 > AC
20	complexity of a technology affects the adoption of information sharing	eQ > 24 > AC
14	Structural alignment	eH > 24 > AC
19	Not all members in the supply chain are connected and have the capability to exchange data from, for example, an ERP system.	eJ > 24 > AC
25	Lack of compatibility between diverse IT systems	o7 > tE >24 > AC
35	Lack of Service exchange	o7 > tE >24 > AC
30	legacy systems impacting knowledge transfer	o7 > tE >24 > AC
37	Lack of technical interoperability	o8 > tE >24 > AC
25	Lack of integration of IT systems and processes	o8 > tE >24 > AC
25	Lack of coordination in knowledge documents	o8 > tE >24 > AC
2	Email is used as a groupware technology	o8 > tE >24 > AC

Table 43 Data integration issues

AC. Data integration issues: Different information systems are not capable of exchanging data.

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Appendix C: Multiple case study details

The author is, Dutch, male, 25 years of age and has obtained a HBO Bachelor's degree in ICT, specializing in management and security. The author obtained interviewing experience during his previous education in the form of user requirements and user satisfaction studies. Besides that the author has done several courses on the TU/e that involved long interviews with practitioners which had executive functions. These interviews, similar to this study, were often conducted in Dutch and transcribed in English.

Participant ID	Pilot	1	2	3	4	5	6	7	8
Who conducted the interview	Author	Author	Author	Author	Author	Author	Author	Author	Author
Education level	Bachelor	PhD	Master	Master	Master	Bachelor	Bachelor	Master	Master
Years of work experience with CKM	8	10	20	36	8	25	13	24	5.5
Gender	Female	Male	Male	Male	Male	Male	Male	Male	Female
How was the participant selected	author's network	Contact provided by author's network	Contact provided by university network	Contact provided by university network	Contact provided by university network	Contact provided by university network	Contact provided by university network	Contact provided by university network	Contact provided by university network
Relationship established	Prior study	Post study	Post study	Post study	Post study	Post study	Post study	Post study	Post study
Organization size	25	12	40+	40-50	90	35	51000, 112 in dep.	25	15
Industry	*Health care*	*IT*	*ICT*	*automate operational processes*	*Education technology consultancy*	*Examination services*	*Banking*	*BI consultancy*	*Examination*
Years of experience in industry	37	20	24	36	8	14	13	24	14
Department	Coordination	Mgt	Mgt	Mgt	M&S	Mgt	Document management	Mgt	-
Function	Coordinator	Director	General director	Director	Account manager	General Director	Manager	Owner & senior consultant	Examination-expert
reasons for attrition	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Interview recorded	by voice recorder	by voice recorder	by voice recorder	by voice recorder	by voice recorder	by voice recorder	by voice recorder	by voice recorder	by voice recorder
Feedback on transcript received	No	No	No	No	No	No	No	Yes	No
Context (where did the interview take place)	office of participant	office of participant	office of participant	office of participant	office of participant	office of participant	office of participant	Coffee room	Office of author
People present during the interview	Author and participant	Author, participant and a non-participating colleague	Author, participant	Author, participant	Author, participant	Author, participant	Author, participant	Author, participant	Author, participant and an observing student
duration of the interview (after intro)	1:50:00	2:02:00	1:30:00	1:40:00	1:35:00	1:25:00	1:40:00	1:35:00	1:25:00
Initial labeling agreement researchers	n.a.	57%	67%	41%	54%	65%	71%	73%	79%

Network drawing typology

During the interviews participants were asked to draw the networks in which their organization operates from their perspective. To anonymize these drawings the following network typology has been developed.

Focal firm
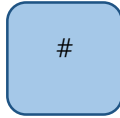
The focal firm will be denoted with a number. This number corresponds with the participants' ID. A number is used to safeguard the anonymity of the participants.

Customers:

- B2B
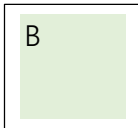
Business to business (denotes one type of business partner, i.e. insurance companies or educational institutions'

- B2C
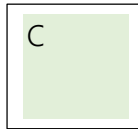
Business to customer (end customer)

- B2G
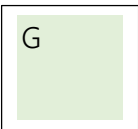
Business to government

Competitors:

This relationship denotes that these two partners consider each other as competitors

Partners:

- Knowledge partners
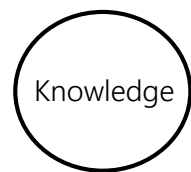
Partners that provide in depth knowledge, such a universities or branch experts

- Technical tooling partners

Partners that provide software

- Technical equipment supplier
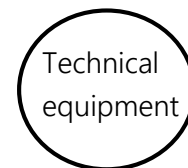
Partners that provide hardware

- Co-Developer
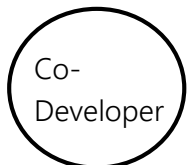
Partners that provide customized products or play a role in the development of products.

- Supplier
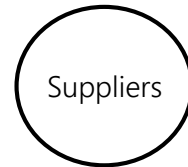
Supplier of non-customized products

- Sales broker
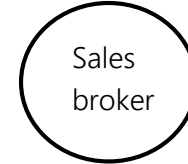
Brokers that sell the service of the focal firm.

- Infrastructure provider

Such as internet service providers or physical locations.
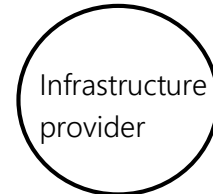
Network drawings

This section presents the anonymized drawings that the participants made of their CC-VNs.
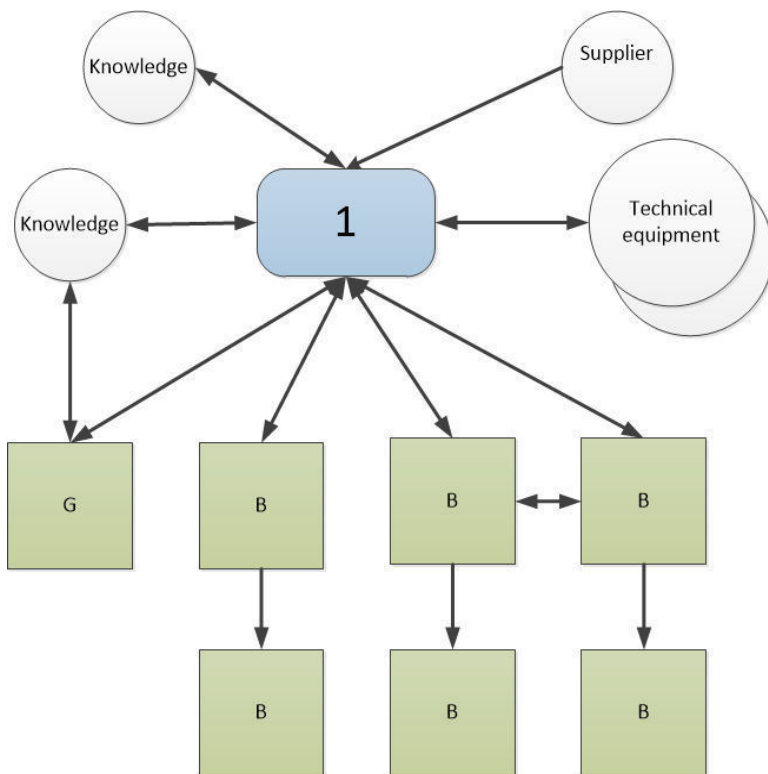
Figure 13 CC-VN #1
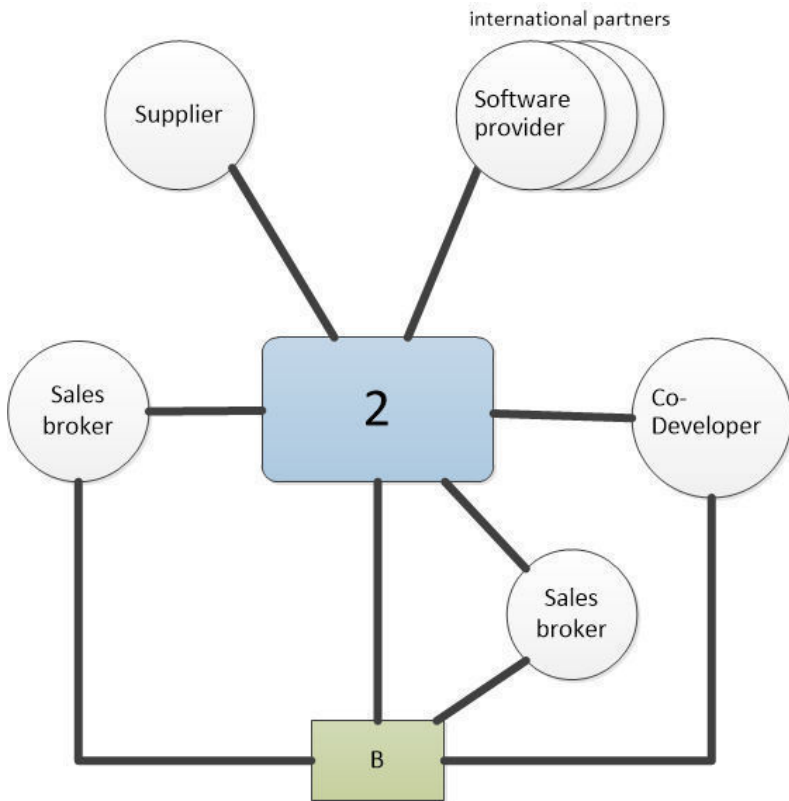
Figure 14 CC-VN #2
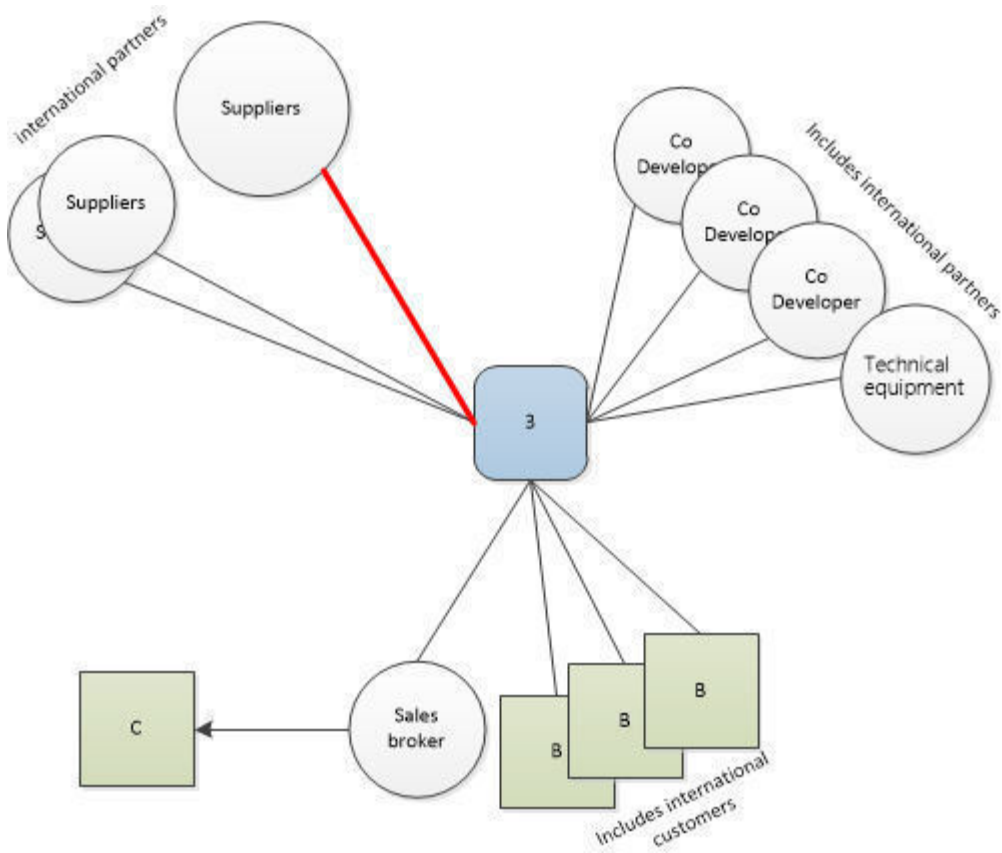
Figure 15 CC-VN #3
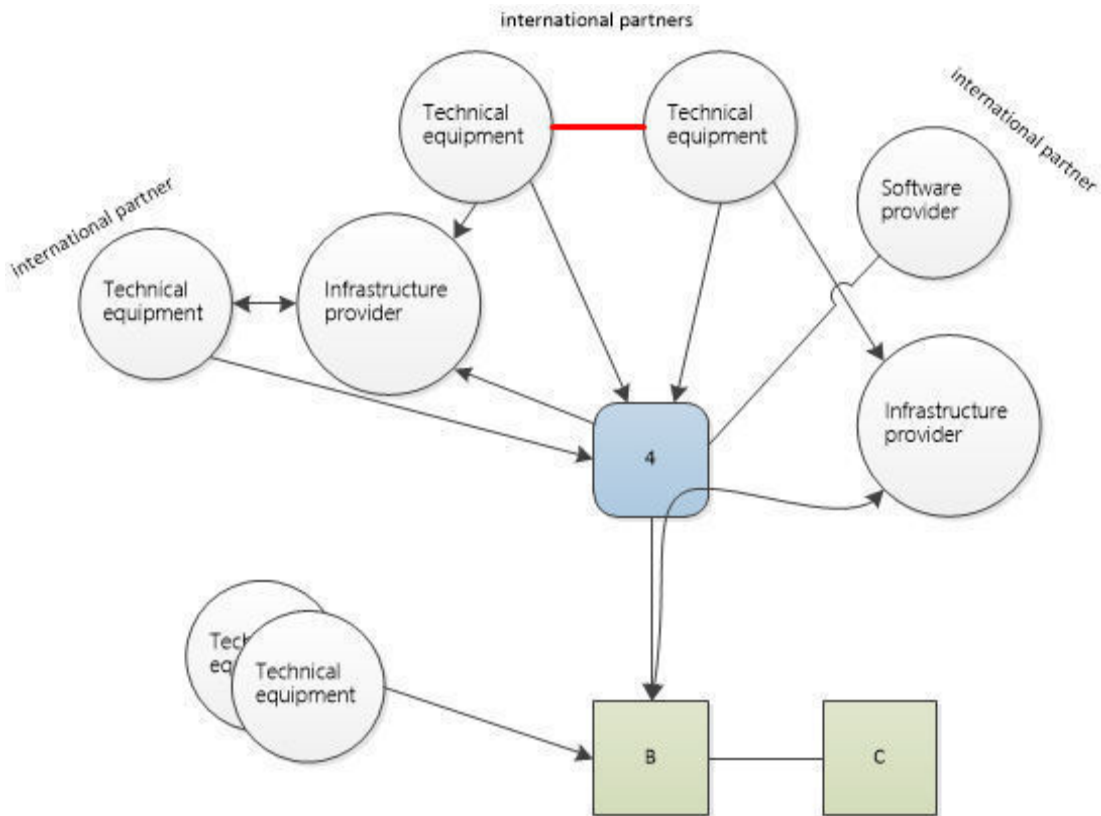
Figure 16 CC-VN #4
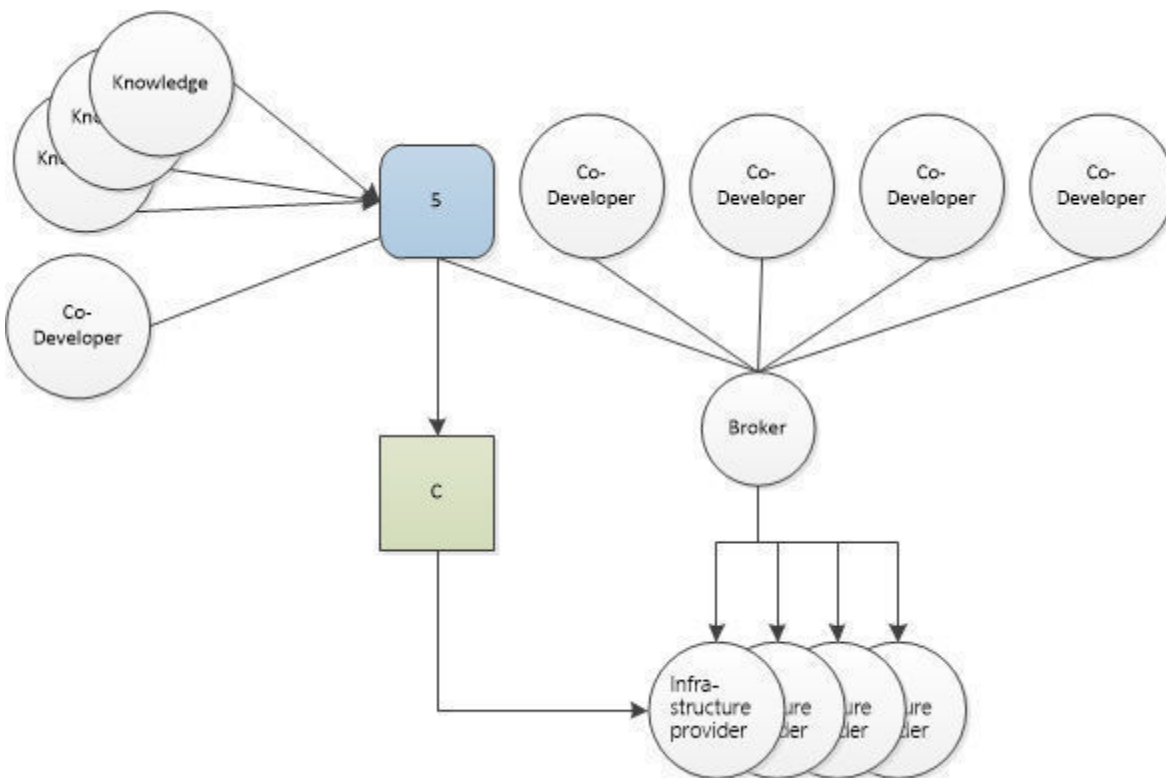
Figure 17 CC-VN #5
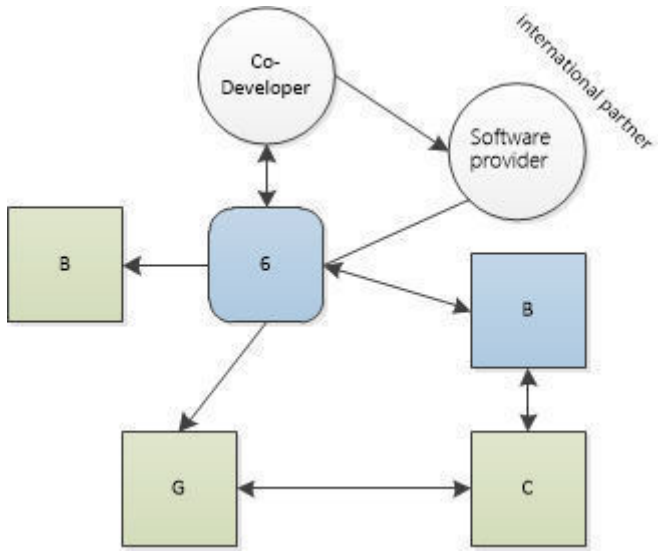
Figure 18 CC-VN #6
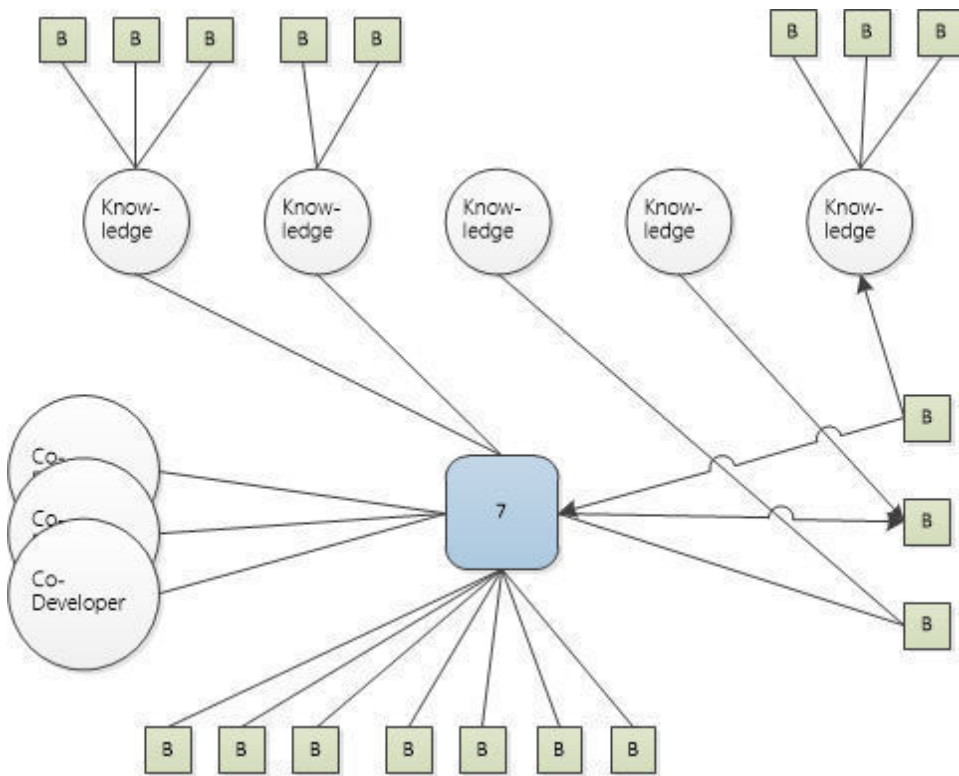
Figure 19 CC-VN #7
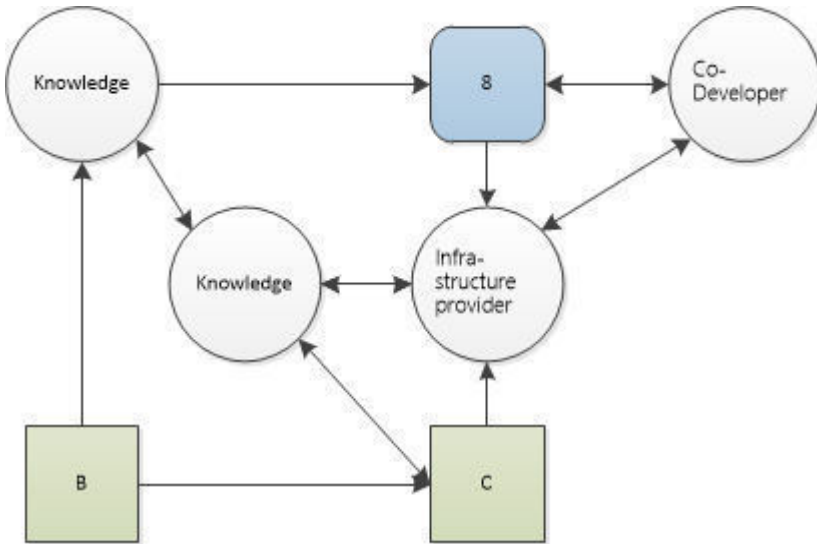
Figure 20 CC-VN #8

CC-VN characteristics

The CC-VNs of the participants have been characterized on the six dimensions of the SODSC framework (Rasouli, Kusters, Trienekens, & Grefen, 2014), see Figure 21, Figure 22 and Figure 23. For the posotioning of the CC-VNs, ealier work in which the SODSC framework was applied was consulted (van Beek, 2015). Van Beek (2015) shows the differences between two dimentions in tables, see Table 44-Table 49. These tables were consulted for the positioning of the CC-VNs in combination with the network drawings (Figure 13-Figure 20). Through positioning the CC-VNs on the SODSC framework, the claim is supported that all of the eight organisations that participated in this study operate in a CC-VN context and not a supply chain context. A typical supply chain would be placed on the bottom left corner of all matrices.

Supplier centric value obtainment	Customer centric value obtainment
Value created by: Value in exchange: *economic benefit by selling service/product*	Service oriented value created by: Value in use; *value is created during the usage of a service/product*
Athlon has a role of a supplier of service/products	Athlon has a facilitating role; helping to create the customer value by offering the usage of a service
Production of service and consumption of service are separated	There are several moments and opportunities for a customer to change its service and co-create a better service for him/her to obtain more value.
A customized solution is developed based on standard service offerings, the customer will consume it over a certain period of time	Constantly a unique customized solution is delivered

Table 44 Service orientation in the Demand Chain perspective, source: (van Beek, 2015).

Single product/Service	Integrated Solution
Product Service Delivery (Rasouli et al., 2014)	Product lifecycle management
Output Oriented (Tukker, 2004) (Rasouli et al. 2014)	Result Oriented

Table 45 Service oriented value in the supply chain perspective, source: (van Beek, 2015).
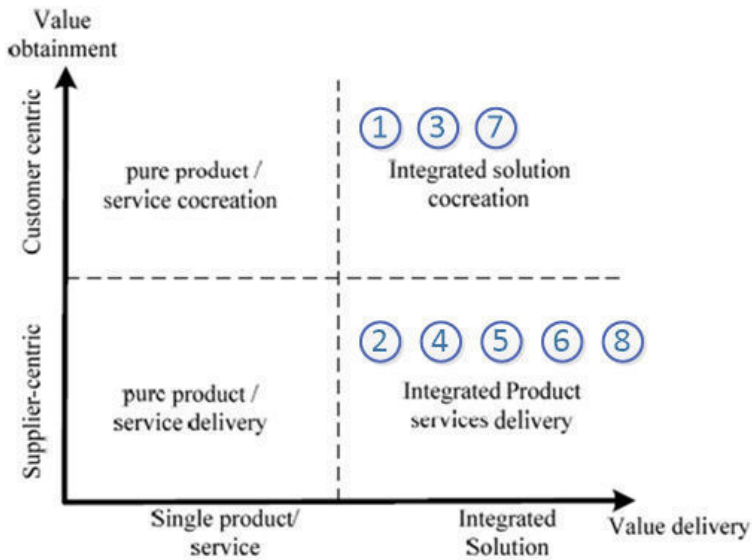
Figure 21 Characterization of service-oriented value

Customer as a passive partner	Customer as an active partner
Transactional interaction	Relational interaction
Customers are a passive audience; they decide to buy a product or not (only feedback)	Customer can engage in dialog with suppliers during each sage of product design and product delivery
Supplier is active: is trying to attract their services (e.g. with 4 P's marketing strategies)	In the extreme form, customers are the most active actor as Co-innovator, co-designers, co-manufactures and co-marketer

Table 46 Service Orientation in the partnership dimensions using the customer perspective (Demand Chain), source: (van Beek, 2015)

Stable partnership	Adaptive partnership
highly structured and rigid supply chains	larger macro-structure which can be more fluid, agile and adaptable
Suppliers as a passive resource	Suppliers as co-developers

Table 47 Service Orientation in the partnership dimension using the supplier perspective (Supply Chain), source: (van Beek, 2015)
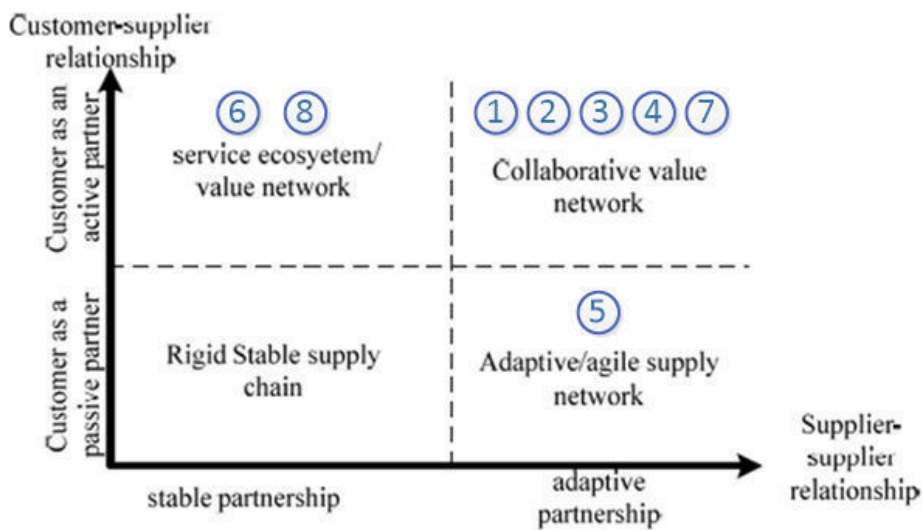
Figure 22 Characterization of the partnership aspect

Supplier adapts network	Customer adapts network
Customer attraction (4P's)	Customer experience (feedback surveys not only on 4P's dimensions but also on usability, sustainability, maintainability of the products/services)
Supplier is active: develops technology and doing research on the applicability of new services	Customer is active with clear needs and ideas
Only feedback moment from customer is that a customer buys it or not	Customer explains why a product is good or not and is involved earlier in the process of product development

Table 48 Service orientation in the control dimension (Demand Chain Perspective), source: (van Beek, 2015)

Central	Decentral
Authorian, highly structured	Collaborative and non-coercive governance (Lusch et al., 2010)
Focus on efficiency	Focus on customer satisfaction
Only performance information and output requirements are shared.	Information is easily shared between actors. Information like customer needs,

Table 49 Service Orientation in the control dimension (Supply Chain perspective), source (van Beek, 2015)
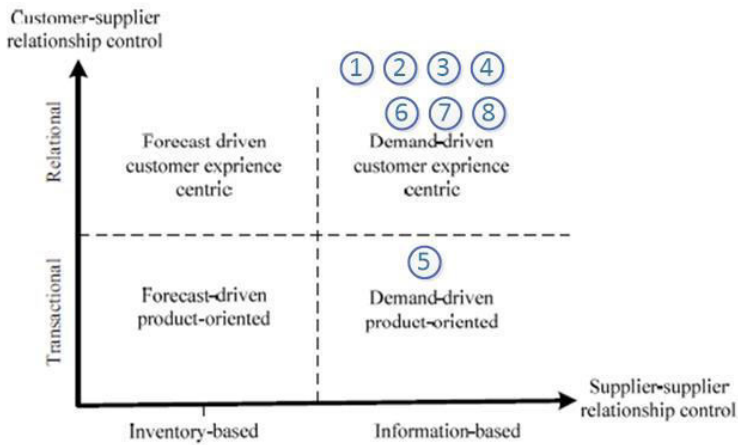
Figure 23 Characterization of control aspect
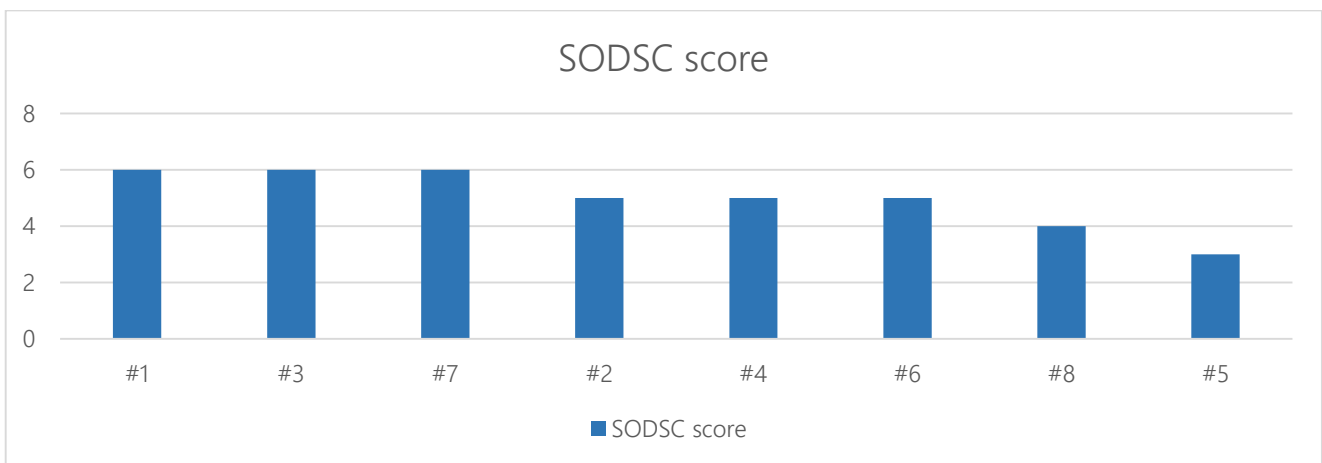
Figure 24 SODSC score

The cases have been 'scored' on the SODSC framework. This score has been calculated as follows: the bottom left corner over every matrix counts as zero points, the top left and bottom right as one point and the top right as two points. CC-VNs that score high on the SODSC framework are oriented more to S-D logic.

Placement reasoning

This section provides a reasoning for the characterization of the CC-VNs that is shown in Figure 21, Figure 22 and Figure 23.

CC-VN #1

Value obtainment

The value that CC-VN #1 creates for its customers through offering highly customized services. The amount of opportunities that the customer has to change the service differs per customer type. Participant #1 did describe that customers continually ask for modifications. Therefore this CC-VN is considered customer centric.

Value delivery

CC-VN #1 provides customized services for which it has to develop products. Therefore CC-VN #1 is labeled as a provider as integrated solutions.

Customer-supplier relationship

Customers are required to provide input so that CC-VN #1 is able to determine what kind of product they have to develop to provide the service a customer wants. Therefore customers are seen as an active partner.

Supplier-supplier relationship

Knowledge partners and technical equipment partners are selected to participate in co-development based on the type of service that a customer requires. Therefore CC-VN #1 is labeled as having adaptive partnerships.

Customer-supplier relationship control

Customers specify what kind of service they need and these services are continuously improved. Therefore CC-VN #1 is labeled as relational.

Supplier-supplier relationship control

CC-VN #1 is demand driven as it requires a customer to specify the service that they want to consume. Therefore CC-VN #1 is labeled as information-based.

CC-VN #2

Value obtainment

CC-VN #2 provides services for software tools that are developed by partners. Customers can specify which services they require and based on this a package is made from standard offerings. The customer is able to provide feedback and report problems. Based on this CC-VN #2 is labeled as supplier centric.

Value delivery

Because CC-VN #2 provides continues services for their products. Customers can contact #2 with questions, feedback and report problems. Therefore CC-VN #2 is labeled as a provider of integrated solutions.

Customer-supplier relationship

Customers are able to engage in dialog with #2 during product delivery. This way customers are able to improve the services they are receiving. Next to this #2 has a co-development partner who communicates what the needs of customers are and based on this new products/services. Therefore CC-VN #2 is labeled as treating customers as active partners.

Supplier-supplier relationship

Based on the services that a customer wants, software-provider partners are selected and together with

these partners services are developed and improved. Therefore CC-VN #2 is labeled as having adaptive partnerships.

Customer-supplier relationship control
CC-VN #2 views their customers as partners. They communicate their specific needs and are able to approach CC-VN #2 during the consummation of the service. Therefore CC-VN #2 is labeled as relational.

Supplier-supplier relationship control
It is difficult to determine whether CC-VN #2 is more demand driven or forecast driven. However, the actors in CC-VN #2 are open when it comes to sharing the needs of customers. Therefore CC-VN #2 is labeled as information based.

CC-VN #3
Value obtainment
CC-VN #3 provides product and services which help their customers automate their operational processes. In order to do this they need close relations with their customers. Therefore CC-VN #3 is labeled as customer centric.

Value delivery
CC-VN #3 develops products which enable customers to automate their operational processes. Alongside with these products they also provide services to continuously improve and update their services. Therefore CC-VN #3 is labeled as a provider of integrated solutions.

Customer-supplier relationship
Customers are involved during development and implementation of integrated solutions. Therefore CC-VN #3 is labeled as treating customers as active partners.

Supplier-supplier relationship
Based on the type of customer, suppliers and co-development partners are selected. Therefore CC-VN #3 is labeled as having adaptive partnerships.

Customer-supplier relationship control
The customers are continuously involved in improving and updating the products and services they consume. Therefore CC-VN #3 is labeled as relational.

Supplier-supplier relationship control
The degree of openness towards partners varies for each partner, but information is shared. CC-VN #3 is demand driven as it requires customers to specify the needs that they have. Therefore CC-VN #3 is labeled as information-based.

CC-VN #4
Value obtainment
CC-VN #4 provides customized IT-infrastructure for its customers with services such as a helpdesk. These customized solutions are developed based on standard offerings. Therefore CC-VN #4 is labeled as supplier-centric.

Value delivery
CC-VN #4 provides services for the products of their partners. Customers can contact #4 with questions and report problems. Therefore CC-VN #4 is labeled as a provider of integrated solutions.

Customer-supplier relationship
CC-VN #4 has ongoing interaction with is customer regarding the services they provide for them.

Customers are able to specify their needs before and during the consummation of services. Therefore customers are seen as active partners.

Supplier-supplier relationship
Partners are selected based on the specific needs of customers. These partners are involved in co-development processes. Therefore CC-VN #4 is labeled as having adaptive partnerships.

Customer-supplier relationship control
Customers are involved before consummation of services because the services are based on customer specific needs. During consummation the customer is able to provide feedback and communicate new needs. Therefore CC-VN #4 is labeled as relational.

Supplier-supplier relationship control
Information about customer needs is shared with partners, such as service windows that fit the customer. CC-VN #4 is demand driven as it requires customers to specify their specific needs. Therefore CC-VN #4 is labeled as information-based.

CC-VN #5
Value obtainment
#5 provides a product/service for which partners of #5 provide a norm. #5 gives feedback on this norm. This often leads to an update of the norm. This continuous collaboration to create an optimal norm implies that the value obtainment is supplier centric. The customer is not able to exert direct influence on the product/service that is provided to him. He can give his opinion through a survey, which will not influence his own experience but might improve the experience of future customers. Since the customer only has limited influence, there is only a light form of co-creation. Hence CC-VN #5 is labeled as supplier centric.

Value delivery
The product that #5 offers is the same for every customer. However, the customer is offered services before he uses the product. The customer is also provided services after he has used the product. Through these services the customer is able to customize how, where and when he will use the product to satisfy the specific needs of the customer. Hence this CC-VN is labeled as a provider of integrated solutions.

Customer-supplier relationship
As described for value obtainment, #5 has a stronger collaboration with its partner than with its customers. Hence CC-VN #5 is labeled as treating customers are passive partners.

Supplier-supplier relationship
#5 is still actively trying to expand its network so it is able to better serve its customers based on their specific needs. As customers are able to choose with which partner they will come into contact. Hence CC-VN #5 is labeled as adaptive.

Customer-supplier relationship control
The customer only has limited control over the product/service. CC-VN #5 determines what to offer based on their knowledge of the customer hence it is labeled as being transactional.

Supplier-supplier relationship control
CC-VN #5 coordinates its activities with partners in multiple ways: Through various communication channels and visits. By doing this they try to improve their operations. Hence the CC-VN #5 is labeled as being information based.

Value obtainment

CC-VN #6 provides value to its customers through offering document management services. These services are continuously improved in collaboration with both partners and customers. Customer's needs are obtained through penal groups and ambassador networks. Because customers can not directly influence the service they receive CC-VN #6 is labeled as supplier centric.

Value delivery

CC-VN #6 delivers a service through the product they provide. Hence CC-VN #6 is considered to be a provider of integrated solutions.

Customer-supplier relationship

Customers are actively engaged by CC-VN #6 about what kind of needs they have. Therefore CC-VN #6 is labeled as treating their customers as active partners.

Supplier-supplier relationship

#6 co-develops their services with their partners. They do this with the same set of partners for all of their customers. Therefore CC-VN #6 is labeled as having stable partnerships.

Customer-supplier relationship control

CC-VN #6 actively encourages their customers to communicate their needs. Therefore CC-VN #6 is labeled as relational.

Supplier-supplier relationship control

It is difficult to determine whether CC-VN #6 operates demand driven or forecast driven. However, information about customer needs is openly shared with partners. Therefore CC-VN #6 is labeled as information based.

CC-VN #7

Value obtainment

CC-VN #7 provides business intelligences services to its customers. Value for the customers is obtained during the consummation of the service. The customer is continuously involved in the development and delivery. Therefore CC-VN #7 is labeled as customer centric.

Value delivery

CC-VN #7 uses products of their partners and to provide services for customers. Therefore CC-VN #7 is labeled as providing integrated solutions.

Customer-supplier relationship

Customers can engage CC-VN #7 in dialog at all times, during development stages and delivery. The service they receive is tailored to them. Therefore CC-VN #7 is labeled as treating their customers as active partners.

Supplier-supplier relationship

CC-VN #7 has a partnership with which they use when they need technical expertise. They have other partners that have domain specific knowledge that they involve depending on the customer. Therefore CC-VN #7 is labeled as having adaptive partnerships.

Customer-supplier relationship control

The customers of CC-VN #7 are involved early in the development process and are able to give feedback during service delivery. Therefore CC-VN #7 is labeled as relational.

Supplier-supplier relationship control

CC-VN #7 operates demand driven as the service they provide is fully customized for each customers. The needs of customers are also shared with partners. Therefore CC-VN #7 is labeled as information based.

CC-VN #8

#8 and #5 are active in the same network. However, their CC-VNs are positioned separately. The reason for this is based on the fact that the network horizon is determined through what the focal firm perceives as the boundary of the network (Heikkinen, Mainela, Still, & Tähtinen, 2007) (Windahl & Lakemond, 2006).

Value obtainment

CC-VN #8 provides software which is based on a standard service offering. The customers obtain value through using this software. CC-VN #8 tries to obtain more knowledge about their customer's needs through site visitations. However, this visitations are more likely to lead to improvements of current offerings than the development of innovative new solutions. Therefore CC-VN #8 is labeled as supplier centric.

Value delivery

CC-VN #8 provides services, on the product that is also provided by them, such as maintenance and customer support. Hence CC-VN #8 is libeled as a provider of integrated solutions.

Customer-supplier relationship

The customers of CC-VN #8 can provide feedback on the services that they consume. They also have influence on the development on the product that is delivered through communicating their needs. Therefore CC-VN #8 is labeled as treating customers as active partners.

Supplier-supplier relationship

CC-VN #8 co-develops their products and services with their partners. However, the partners that are involved are not highly dynamic. Therefore CC-VN #8 is labeled as having stable partnerships.

Customer-supplier relationship control

Customers of CC-VN #8 are able to communicate their needs and provide feedback. Therefore CC-VN #8 is labeled as being relational.

Supplier-supplier relationship control

It is difficult to determine whether CC-VN #8 operates demand driven or forecast driven. However, information about customers' needs is easily shared with partners. Therefore CC-VN #8 is labeled as information based.

Determining the most relevant KTIs to be included in the Delphi study

At the time the Delphi study started, seven cases had been studied in the multiple case study. This section presents the rationale for selecting the KTIs that were included in the Delphi study.

Average importance	KTI-ID
3	AD
2.6666667	AB
2.5	AC
2.3333333	H
2.3333333	N
2.25	C
2.1666667	Z
2	D
2	I
2	J
2	R
2	U
1.8333333	L
1.8	K
1.8	M
1.8	AA
1.75	E
1.7142857	O
1.6666667	G
1.6666667	P
1.6666667	W
1.6	A
1.5	B
1.5	S
1.5	V
1.5	Y
1.25	Q
1	F
1	T
1	X

Table 52 recognition of KTIs

% recognition	KTI-ID
85.71429	B
85.71429	W
71.42857	J
71.42857	L
71.42857	N
71.42857	O
71.42857	R
71.42857	Z
57.14286	C
57.14286	D
57.14286	E
57.14286	K
57.14286	M
57.14286	Q
57.14286	U
57.14286	AC
42.85714	A
42.85714	G
42.85714	I
28.57143	H
28.57143	P
28.57143	S
28.57143	V
28.57143	AA
28.57143	AB
14.28571	T
14.28571	X
14.28571	Y
14.28571	AD
0	F

Table 51 importance of KTIs

KTI-ID	Structural network issues	Inclusion for Delphi study
A	Transactive memory issues	Lack of importance and recognition
B	Relationship issues	Unlikely a technical solution exists
C	Complex network issues	High importance and recognition
D	General distance	Unlikely a technical solution exists
E	Cultural distance	Unlikely a technical solution exists
F	Lack of communication facilities	Lack of recognition
	Generic issues	
G	Difficulty to express tacit knowledge	Unlikely a technical solution exists
	Social issues	
H	Knowledge source reliability issues	Lack of recognition
I	Fear of losing knowledge	Unlikely a technical solution exists
J	Lack of willingness	High importance and recognition
K	Lack of trust	Unlikely a technical solution exists
	Language / understanding	
L	Insufficient mutual understanding	High recognition
M	contextualization issues	Lack of importance and recognition
N	Semantic issues	High importance and recognition
	Organizational issues	
O	Organizational issues	High recognition
P	Lack of top management commitment	Lack of recognition
Q	Network level objective and benefit issues	Lack of importance
R	Insufficient resources	High importance and recognition
S	Organization structural issues	Lack of recognition
T	Lack of incentive	Lack of recognition
U	authorization / data access	High importance and recognition
V	Performance measurement issues	Lack of recognition
W	Legal issues	High recognition
AG	Too many communication facilities	Not enough data
	Technical issues	
X	Failure to meet technological demand	Lack of recognition
Y	Lack of user-friendly IS	Lack of recognition
Z	Data quality issues	High importance and recognition
AA	Data overload issues	Lack of recognition
AB	Data security issues	Lack of recognition
AC	Data integration issues	High importance and recognition

Table 50 overview of KTIs and argumentation for Delphi study

KTIs category importance per case

This section presents graphs which show how many *strong* examples each case could provide in a particular KTI category. It is important to realize when looking at these graphs that the maximum number of *strong* examples is 8 (eight cases) and that the maximum value for 'average importance' is 24 (as importance was rated on a scale from 1 to 3 per example)
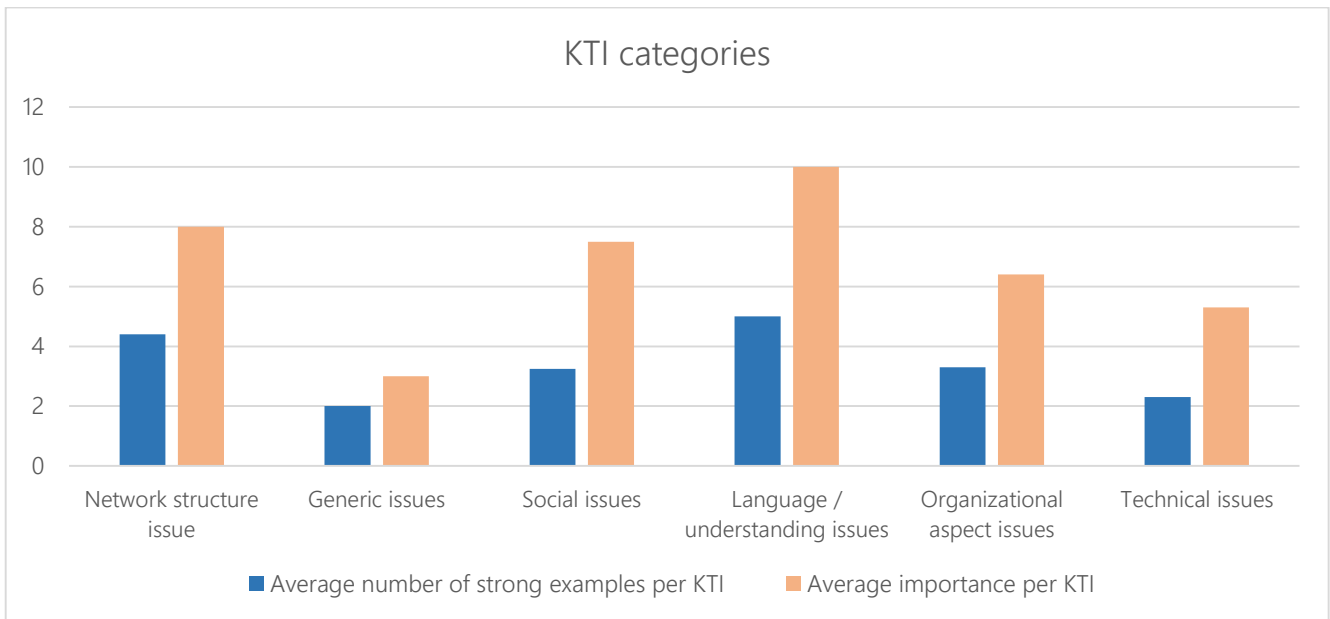
Figure 25 average number of examples and importance per category
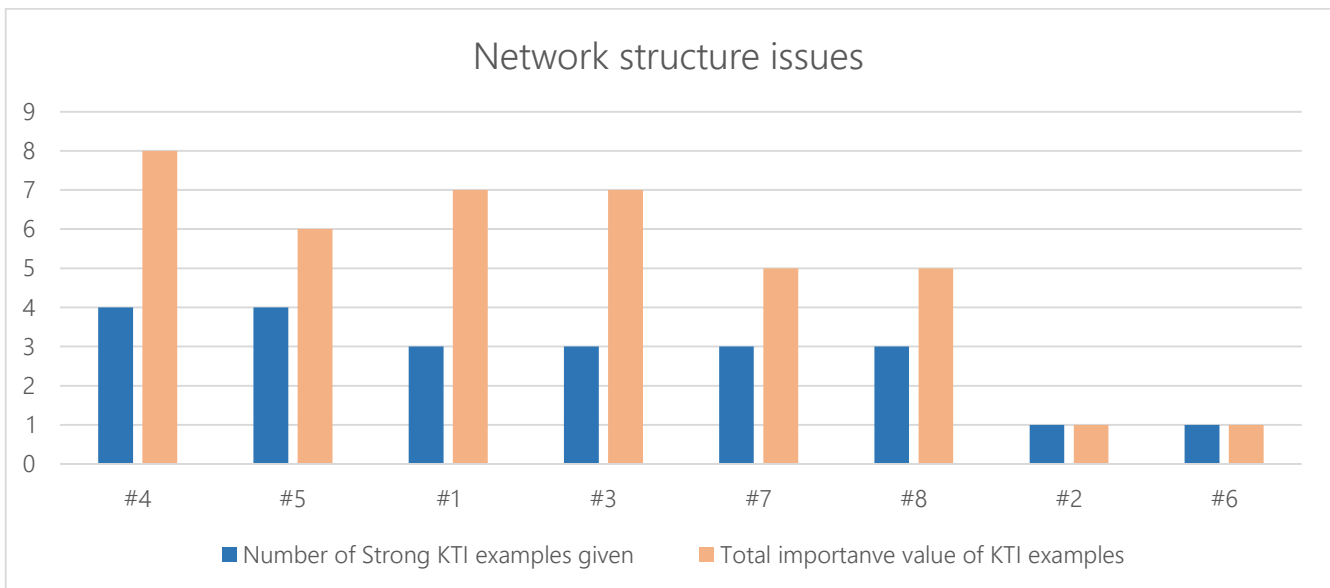
Figure 26 average number of examples and importance for Network structure issues

Figure 27 average number of examples and importance for Generic issues

Figure 28 average number of examples and importance for Social issues

Figure 29 average number of examples and importance For Language / understanding issues

Figure 30 average number of examples and importance for organizational aspect issues

Figure 31 average number of examples and importance for Technical issues

Appendix D Interview protocol

The structure of this interview: first the researcher introduces himself and the project. After that the interviewee is asked to make a drawing of how he/she perceives his/her value network, followed by questions based on the KTI classification framework.

Introduction of the researcher
the researcher introduces himself, explains how this interview is part of his master graduation project at the TU/e for the Business Information Systems master. He's doing his project at the de Industrial Engineering & Innovation Sciences faculty. His project is part of the research of a PhD student. In his graduation project he researches knowledge transfer issues (KTIs) *Issues in the context of Value Networks.* His project has two distinct goals: 1. determining which issues play in practice 2. Finding possible solutions to these problems.

Introduction of the project and goal of this interview, and the coming interviews

First the outline of the research is explained using Figure 32: The study is organized as follows: First, we looked at KTIs described in literature. This resulted in over 200 issues. These issues were merged together with the research group to 29 issues. It now remains to be determined whether these issues occur in practice, and if there are no obvious problems missing from the list. This will be verified through conducting interviews with experts. The purpose of this interview is verifying which issues are experienced by and relevant to practitioners such as you. After interviewing all experts, all the KTIs discussed by all the experts will be merged.

The next stage of this master project consists out of applying a Two round Delphi process. There will be two more rounds of interviews with experts. These experts are anonymous to each other but get to know the views of other experts. The aim is exploring solutions to verified problems. In the first round you'll tell what you think are possible solutions to the KTIs and why they should work. After the first round of interviews is finished, all the possible solutions discussed by all the experts will be

Figure 32 research outline

merged together and feed back to all of the experts in the next round of interviews. Experts then have the possibility to reflect on earlier suggestions or to supplement or improve on the solutions offered by other experts. Through this method, well thought-out solutions should be found for problems that occur in practice.

Structure of the interview (interview protocol)

The goal is: verifying if the KTIs that are found in literature exist in practice. To do this you are asked to provide that you've experienced with regards to knowledge transfer. So, to clarify, actual experiences, and not opinions.

In order to analyze the interview properly the interview should be recorded, with the participant's permission. During the study the recordings are kept secure and once the study is over the recordings will be destroyed.

A report will be made of the interview that will be mailed to the participant, so he can verify that his input has been interpreted and translated everything correctly. It should be emphasized that the participant does not have to participate in all interviews if he, for any reason, does not want to and that he also has the right to not answer a particular question if, for any reason, he does not want to.

Before the interviews start a small drawing of his value network should be made. This activity helps to better understand his situation and, it will also become clear to how your end customer fits into his value network. Throughout the interview the drawing should be left on the table to help keep the focus on the network. After this continue with questions that are related to KTIs. The interview ends with more general, less structured questions regarding the completeness of the framework.

Value Network

1. What customer knowledge/information do you currently use?
Goal: to get an understanding of what the organization does and how the interviewee sees this.

2. Could you tell me what the, let's say 5, most important issues are that you have or are experiencing with CKM, and then particularly within the context of the network.
Goal: This question serves multiple goals: it becomes clear which issues are most important to the interviewee, it helps verifying issues that are included in the KTI classification framework and possibly identify issues that are not mentioned in literature, adding to (but not guarantying) the completeness of the list and it allows the interviewer to become familiar with the jargon of the interviewee.

3. I have a table with issues that are mentioned in literature. I would like to go through this table with you. If you have ever come into contact with an issue I would like you to give me an example.
Goal: verification of KTIs

3*[if the problem occurred], is the issue still present? How important is this issue to you? Why do you think that?
Goal: getting an indication for the importance of the KTIs.

The ID column states the resulted index from the Metaplan sessions, the blue horizontal rows are the category titles. The notes column allows the interviewer to enter notes during the interview such as the time at which an interviewee gives an example of a particular issue. This assists the analysis of the interview.

ID	Issues	Description given during Metaplan sessions	Notes
		Organizational issues	
1/30 O	Organizational issues	The organization does not have sufficient formal planning, guidelines or regulations for knowledge sharing. This makes it unclear who is responsible, and what and how data should be shared.	
		De organisatie heeft onvoldoende formele planning, richtlijnen of regelingen voor het delen van kennis. Hierdoor is het onduidelijk wie er verantwoordelijk is, wat er gedeeld moeten worden en hoe het gedeeld zou moeten worden.	
2/30 P	Lack of top management commitment	Due to lack of top management commitment and involvement, knowledge sharing initiatives lack a mandate, causing them to fail.	
		Door een gebrek aan commitment en betrokkenheid van het bestuur, hebben initiatieven rondom het delen van kennis een gebrek aan mandaat waardoor ze mislukken.	
3/30 Q	Network level objective and benefit issues	Given power asymmetry and goal problems at the network level, actors do not equally benefit from knowledge sharing.	
		Organisaties begrijpen het netwerk-doel niet of ze hebben niet evenveel voordelen van het netwerk-doel, waardoor ze minder graag deelnemen.	
4/30 R	Insufficient resources	Lack of resources such as expertise, training, time, funds, and network structure cause difficulties for knowledge sharing.	
		Een gebrek aan middelen zoals: gebrek aan expertise, training, tijd en geld. Zorgt voor problemen rondom het delen van kennis.	

5/30 S	Organization structural issue	Inflexibility results from excessive hierarchy and centralization, or too many guidelines and regulations. People may be willing to share, but lack the authorization.	
		Er is teveel hiërarchie en centralisatie of er zijn teveel richtlijnen en regels, waardoor inflexibiliteit ontstaat. Mensen willen misschien wel delen maar ze zijn er niet toe bevoegd.	
6/30 T	Lack of incentive	People are not motivated to share their knowledge due to a lack of incentives in the form of accolades or rewards.	
		Mensen zijn niet gemotiveerd om kennis te delen door een gebrek aan aansporing, in de vorm van erkenning of beloningen.	
7/30 U	authorization / data flow	Data exists but is not mobile. People cannot access it and therefore they cannot derive value out of it.	
		Data bestaat maar is niet mobiel. Mensen kunnen er niet bij komen, daardoor kunnen ze er geen waarde uit halen.	
8/30 V	Performance measurement issue	Without monitoring control and evaluation procedures it is impossible to tell how KM system is performing.	
		Zonder toezicht en evaluatie procedures is het onmogelijk om vast te stellen hoe het kennismanagementsysteem presteert.	
9/30 W	Legal issues	Laws and regulations may put constrains on inter-organizational knowledge sharing.	
		Wet- en regelgeving leggen beperkingen op aan het delen van data tussen organisaties.	

ID	Issues	Description given during Metaplan sessions	Notes
	Structural network issues		
10/30 A	Transactive memory issues	Refers to the set of knowledge possessed by group members coupled with an awareness of who knows what.	
		Is gedefinieerd als de kennis die een groep mensen heeft gelinkt aan een bewustzijn van wie wat weet.	
11/30 B	Relationship issues	Collaborations between actors are hindered because of personal relationships. One firm feels superior over the other.	
		Samenwerking tussen mensen word bemoeilijkt door persoonlijke relaties. Een partij voelt zich superieur over de ander.	
12/30 C	Complex network issue	Extreme complexity in terms of relationships, communications, and use of knowledge.	
		Extreme complexiteit in termen van relaties, communicaties en de samenvoeging en toepassing van kennis.	

13/30 D	General distance	Physical or time distance between actors creates difficulties in knowledge sharing.	
		De fysieke afstand tussen partijen veroorzaakt problemen rond het delen van kennis.	
14/30 E	Cultural distance	All actors must know each other's respective cultural backgrounds. Views and ideas can be negatively influenced by not knowing languages people speak, their habits, and what is acceptable and what is not.	
		Het is belangrijk dat partners elkanders culturele achtergrond kennen. De taal die mensen spreken, de gewoontes die ze hebben, weten wat geaccepteerd wordt en wat niet.	
15/30 F	Lack of communication facilities	Lack of opportunities for communication and lack of formal/informal mechanisms, making it difficult to transfer knowledge across a network.	
		Mensen zijn gelimiteerd in hun communicatie opties, een gebrek aan formele/informele mechanismes, dat maakt het moeilijk om kennis te delen in een netwerk.	
16/30 AD	Too many communication Channels	There are so many communication channels available that it becomes unclear what type of information should be communicated over a certain channel. What is the best channel? Do people regularly read all channels?	
		Er zijn zo veel communicatie kanalen beschikbaar dat het onduidelijk wordt welk type informatie over een bepaald kanaal gecommuniceerd kan worden. Wat is het best kanaal? Bekijken mensen regelmatig alle kanalen?	

ID	Issues	Description given during Metaplan sessions	Notes
	Technical issues		
17/30 X	Failure to meet technological demand	Technology in place is inadequate (e.g. lack of functionality, architectural issues, system security) to support a network's actual knowledge transfer process.	
		De technologie ter plaatse is niet in staat om daadwerkelijke bedrijfsprocessen te ondersteunen.	
18/30 Y	Lack of user-friendly IS	The system is not adequately user friendly.	
		Het systeem is niet gebruiksvriendelijk genoeg.	
19/30 Z	Data quality issues	Refers to availability, privacy, accessibility, accuracy, and completeness of shared data.	
		Data kwaliteitsproblemen verwijzen naar: beschikbaarheid, bereikbaarheid, nauwkeurigheid, privacy en volledigheid van de gedeelde data	
20/30 AA	Data overload issue	There is more data available than that there is processing capacity available.	
		Er is meer data beschikbaar dan er verwerkingscapaciteit beschikbaar is.	
21/30 AB	Data security issue	Technological issues generate reliability and security concerns in knowledge transfer.	
		Door technologische problemen is data onvoldoende beschermd.	
22/30 AC	Data integration issue	Different information systems are not capable of exchanging data.	
		Verschillende informatiesystemen zijn niet in staat om data uit te wisselen.	

ID	Issues	Description given during Metaplan sessions	Notes
	Language / understanding		
23/30 L	Insufficient mutual understanding	Unable to make good use of the others' knowledge due to a lack of common ground, casual ambiguity, difference in perception, or lack of knowledge of exactly how the knowledge is supposed to be used.	
		Niet in staat zijn om de kennis van anderen te benutten, vanwege een gebrek aan gedeelde achtergrond, dubbelzinnigheid, verschil in perceptie, of men weet niet precies hoe de kennis gebruikt dient te worden.	
24/30 M	contextualization issues	Context can be defined as information about the situation, intentions, and feelings about an issue or action. Losing the context of knowledge can be an issue, especially for tacit knowledge.	
		Context kan worden gedefinieerd als informatie over: de situatie, bedoelingen en gevoelens rondom een probleem of actie. Het verliezen van context kan een probleem zijn. Bijvoorbeeld als de afstand tussen twee objecten 14 is, dan is het goed om te weten of dat in cm of in inches is.	
25/30 N	Semantic issues	Use of different terminology or meanings of words can cause misunderstandings.	
		Het gebruik van verschillende terminologie of betekenis van woorden kan misverstanden veroorzaken.	
	Generic issues		
26/30 G	Difficulty to express tacit knowledge	People are unable to externalize/codify their tacit knowledge.	
		Mensen zijn niet in staat om hun impliciete kennis expliciet te maken.	

ID	Issues	Description given during Metaplan sessions	Notes
	Social issues		
27/30 H	Knowledge source reliability issues	Knowledge is not perceived as true because its source is unreliable.	
		Kennis wordt niet gezien als correct/waar vanwege de (on)betrouwbaarheid van de bron.	
28/30 I	Fear of losing knowledge	Since knowledge is a source of competitive advantage, there is fear that when it is shared, it is shared with partners that could be competitors.	
		Omdat kennis een bron is van concurrentievoordeel, is er angst dat wanneer kennis wordt gedeeld, het gedeeld wordt met partners die in de toekomst een concurrent kunnen worden.	
29/30 J	Lack of willingness	People don't want or are unmotivated to engage in knowledge sharing for reasons, including knowledge as a power syndrome, lack of trust in people, resistance to change, or fear of exploitation.	
		Mensen willen niet meedoen aan het delen van kennis vanwege verschillende redenen, die uiteenlopen van 'kennis is macht' tot 'dat is niet hier bedacht dus wil ik er geen gebruik van maken'	
30/30 K	Lack of trust	A belief that the other party might act opportunistically or in an unfavourable way hinders knowledge sharing across a network.	
		Het vermoeden dat een andere partij misschien opportunistisch, of niet wenselijk, gaat handelen.	

4. You haven't come into contact with some issues, but perhaps you do have an opinion about how important these issues are? Could you indicate that? (go through the list again), why do you think that?
Goal: get indications for the importance of KTIs.

5. Are there CKM issues in your network that you've ever had or still have, which you haven't had a chance to mention yet?
Goal: give the interviewee an opportunity to mention more issues in a category that we've already discussed or mention an issue that the interviewer was unaware off, adding to the completeness of the list. Additionally the interviewee is given a chance to end the interview politely by saying "no", or to continue in an unstructured manner.

Thank you for your time, if it is ok with you I would like to end the interview with some general questions.

A. General information about the organization

    1. Is it correct that ORGANISATIONNAME operates in the …………………………………. industry?

    2. How large is your organization? ……………………………………………………………………

B. General information about the expert

    1. How many years of experience do you have working in X industry?   ………………

    2. How many years of experience do you have in the field of KM?   ……………………

    3. What is the highest level of educational that you've completed? ……………………

Thank the participant. Say that an interview report will be send as soon as possible so that he has the opportunity to verify that everything has been correctly interpreted

Appendix E Multiple case study interviewee statements

The tables in this appendix contain states from interviewees which have been translated from Dutch to English and have been condensed to make them presentable. Figure 33 explains how these tables should be read. (the fields that are marked yellow have not been shown to the participants in the Delphi study.

Example of a KTI in practise

KTI-ID

ID of the interview participants

Second example

Importance label assigned by research group

Description from participant of: why it is important

Solutions mentioned during the interview

Internal examples

A	1	2	3	4	5	6	7	8
Example	-	-		Customers ask questions about services we can't deliver	I didn't know a partner had similar plans of starting abroad, we could exchange knowledge			Part of the network is a new club, a new collaboration, there is no collective memory yet
Example #2	-	-						
W issue	networking itself, how can customers find us	-						
imp value	2	3		1	1			1
importance	If you know where you can ask a question you progress faster	It costs you: opportunities, efficiency, engagement, so we do see it as an important issue		Often a partner can deliver the service so it is not important	It is not important because if I don't know it I'll find a way on my own			They just started building it. I think it is part of the process
Solution								
Internal		Old employer (large organisation), awareness of other departments activities with customers				In our organisation some people don't know what we can do in our department		
imp value		3				1		
Importance		It can make or break projects				it was more of an issue in the past		

* All the descriptions and examples have been translated (from Dutch to English) and condensed (to make them presentable)

Figure 33 Table explanation

Transactive memory issues:

Is defined as the set of knowledge possessed by group members coupled with an awareness of who knows what.

Issues include:

Physical distance between network members, indirect technology-mediated interactions between them, a lack of antecedent collaborative history, and the typical diversity in expertise and backgrounds of members constrains the development and maintenance of transactive memory.

A	1	2	3	4	5	6	7	8
Example	-	-		Customers ask questions about services we can't deliver	I didn't know a partner had similar plans of starting abroad, we could exchange knowledge			Part of the network is a new club, a new collaboration, there is no collective memory yet.
Example #2	-	-						
W Example	networking itself, how can customers find us	-						
imp value	2	3		1	1			1
importance	If you know where you can ask a question you progress faster.	It costs you: opportunities, efficiency, engagement, so we do see it as an important issue		Often a partner can deliver the service so it is not important	It is not important because if I don't know it I'll find a way on my own			They just started building it. I think it is part of the process.
Solution								
Internal		Old employer (large organisation), awareness of other departments activities with customers				In our organisation some people don't know what we can do in our department		
imp value		3				1		
Importance		It can make or break projects.				it was more of an issue in the past		

Relationship issue

Collaborations between people are hindered because of personal relationships. One party feels superior over the other.

B	1	2	3	4	5	6	7	8
Example	A partner has better relations with end customers		One partner is so large, who am I to him? I can't avoid them, they are a too important player in the market.	Partners require us to get certificates to install their systems	My partner collaborates with someone that I feel superior too and he feels like the underdog	When employees of partners want to start working for us they think we feel superior	Some customers are larger than their partners and force them to adapt their systems to them	Large network members find themselves more important than others. They are demanding in what they want
Example #2							Partners can see us as suppliers at first and feel superior.	
W Example								
imp value	2		2	1	2	1	1	3
importance	The lower in the chain the harder it is to reach a good price		It is an issue that you have to manage.	They just want their partners to provide good services.	It's not good for the collaboration	It is a bigger issue for smaller companies	Once they see the value that we add the feeling of superiority is removed	They have so much influence on process design that it influences the work process of all other network members.
Solution	think strategically, how can we make our product so that we end up high in the chain		By selecting partners of the same size.					

Complex network issues

Extreme complexity in terms of relationships, communications and the assembly and use of knowledge. *when doing large-scale projects. Basically this is can cause other issues, such as transactive memory constraints, relationship issues, communication problems etc.

C	1	2	3	4	5	6	7	8
Example			Being excluded from a project and included again in a later stage	(1)Two partners are each other's largest competitors	New partners don't understand the complexity of the network		Project goals become fuzzy when a lot of parties are involved	
Example #2				(2)We involve a lot of partners to provide solutions. when one is late during the installation it has huge impact on the testing process				
W Example								
imp value			2	3	1		3	2
importance			It is difficult to manage	(1)Often a partners new products don't combine with the products of other partners. (2) customers won't be able to use the system in time	I know my role and what I can and cannot say.		it limits the changes of success	Because you have to deal with more people. Which can be a hindering element.
Solution				(1)Get a third party to mediate some conversations				

General distance

Physical distance between parties creates collaboration issues. People feel like they don't "know" the other party well enough or that they are on the same team.

D	1	2	3	4	5	6	7	8
Example	makes communication and the sharing of resources such as experiment-settings hard	-		Without at least one meeting goal problems occur	Starting abroad is hard because I have to go there		-	All parties are spread out around the Netherlands. So the get everyone in a meeting can be a struggle.
Example #2		-					-	
W Example		-					People still have the tendency to be close to each other	
imp value	3	1		3	2		1	1
importance	efficiency problem	Solvable with ICT, less of an issue for new generations		After meeting once communication improves	it is an inconvenience		we are getting better at using digital aids	it is not perceived as a very big problem.
Solution	Make work packages independent			Do a joint kick-off				

Cultural distance

It is important that all partners know each other's respective cultural backgrounds. The language people speak, the habits that they have, knowing what is accepted and what is not. Not knowing these things can negatively influence collaboration. When culture is not made explicit people can become hesitant to share their views and ideas.

E	1	2	3	4	5	6	7	8
Example	no reply to an offering due to a lack of relationship building	Less direct cultures that have a tendency to keep things to themselves	Some cultures prefer to work with their friends				With some cultures I have to spend a lot of time in becoming accepted	
W Example								
imp value	2	1	3				1	1
importance	it becomes important when you are not aware of this	If it occurs you can tackle it	People do business with people. Everything that is human is important				I enjoy doing it	I don't think it is an issue
internal					A supplier has a different attitude to working			
imp value					3			
importance					Paying too much for nothing			

Lack of communication facilities

People are limited in their communication options, making it difficult to collaborate efficient and effectively.

F	1	2	3	4	5	6	7	8
Example		-						
Example #2		-						
W Example		-						
imp value		1					1	
importance	I don't understand how you selected this issue	Can be the biggest hurdle to solving physical distance issues	No, not an issue. Especially not in these days. Internet solves it all	This doesn't occur. Modern techniques. Sometimes we make WhatsApp groups with partners. If necessary we can reach each other at all times.	No, does not ring a bell	Everyone has a phone and a laptop	In these days that is absolutely a no-brainer. I really don't see a problem here.	In these days that shouldn't be allowed to be a problem.

Difficulty to express tacit knowledge

People are not able to express/Externalize their tacit knowledge.

G	1	2	3	4	5	6	7	8
Example	explaining how to communicate with customers			Some technical staff should not talk with customers as they give things away for free				
W Example							It occurs in a broad sense	
imp value	2			1			2	1
importance	You need to make sure that people do the work that they are good at			This is just a challenge.			Companies don't break on this	No, I don't think it's much of an issue.
Solution				We discuss who says what before we have a session with customers				
internal		How people do their work is in their minds, you can't ask them to write that down						
imp value		1						
importance		It is only a problem if a lot of people leave the organisation						

Knowledge source reliability issues

Knowledge is not perceived correct / true because of its source reliability.

H	1	2	3	4	5	6	7	8
Example	-	-			(1) Sometimes it is in our partners interest to provide us with wrong information			After a discussion about opinions people say that 'they lost'. While there were no bad idea, the best idea was just chosen.
Example #2	-	-			(2) The validity of the research of an intern, can I share it with partners			
W Example	Some partners say one thing and do something else	-						
imp value	3	1			3			2
importance	Related to reliability.	not important			(1) It is our job, we need to double check everything. (2) the proof that interns have to deliver covers it			Political games make the collaboration difficult.

Fear of losing knowledge

Since knowledge is a source of competitive advantage, there is a fear that when it is shared, it is shared with partners that could become competitors.

I	1	2	3	4	5	6	7	8
Example	Sharing information to a partner about an existing customer who then takes over the customer relation		5 guys said they came to talk but just provoked an architect in to leaking knowledge		A partner has been sold to a competitor			
W Example			When people join hackathons they give away knowledge					
imp value	3	1	3		1			
importance	when the partner makes cuts in the offering, our part is cut out the most	covered by NDAs			I don't have any secrets			
internal	people leaving			People leaving				
imp value	3			1				
importance	knowledge is our asset			that's just life				

Lack of willingness

People don't want to engage in knowledge sharing for various reasons which range from knowledge is power syndrome to not invented here syndrome.

J	1	2	3	4	5	6	7	8
Example	Partner wants to receive knowledge but doesn't give it back, they fear losing value	People still prefer using email instead of new systems	Partners want to collaborate but don't want to share				Architects sometimes feel that they need to know everything about something before they share their thoughts	Existing network members are not willing to help new network members. Power games.
Example #2								Some partners don't find it necessary to sit around a table and share things with each other.
W Example					Sometimes someone is not willing to assist us		A lack of passion for sharing from participants, prefer taking instead of giving.	People are not motived to share knowledge. For some people it is charity work.
imp value	3	2	3		1		2	3
importance	When you collaborate you can do more than you can do separately	The issue will always be there. Where you observe it you can tackle it	If I feel that it happens it is over.		We just call the next		The role architect is very important, if they don't share knowledge it results in bad solutions	You'll always be confronted with conflicting interests. It doesn't cause progress.
Solution								
internal						Some people are single points of knowledge and they like being indispensable		
imp value						1		
importance						It is a thread to continuity, it is being solved		

Lack of trust

A belief that the other party might act opportunistically/ in a non-favorable way. Hindering knowledge sharing across a network.

K	1	2	3	4	5	6	7	8
Example	Some partners want exclusive rights. They worry that the customer will go straight to us.		Not being able to speak freely, the risk of opportunistic behaviour		When a partner says he'll introduce me somewhere, he could run off with my idea			There is a big partner that thinks that the smaller partners only have commercial interests and don't focus enough on quality.
Example #2								
W Example		To prevent others from doing things with our knowledge that are not in our interest we use NDAs						
imp value	3	1	3		1			1
importance	slows down progress	working on trust is preferred	It makes free collaboration difficult		Not a important issue			I don't think it influences the quality of work.
Solution			Make it discussable. Express concerns					

Insufficient mutual understanding

Not being able to make good use of the others knowledge due to lack of common ground, casual ambiguity, difference in perception, or one does not know exactly how the knowledge is supposed to be used.

L	1	2	3	4	5	6	7	8
Example	customers are not at all technically savvy		Partners have a different view, they look at one item while we look at the whole process	(1) Customers can't formulate questions.	Differences in perception, partners make decisions that are not in our interest		We have so much knowledge that we have to bring all the parties involved on par. This costs some energy.	A network member thought we made a mistake and had a lot of discussions about it with another network member, once they told us we could explain it was correct
Example #2	Differing disciplines make it difficult to communicate			(2)Not every employee of customers has a technical background	Partners can give input on things for which they lack know-how.			
W Example								
imp value	3	1	1	1	3		2	2
importance	You have an obligation to translate things in your communication when reporting progress. And you can only sell something to the customer when they see the offer as an solution	It is more of a cultural issue to me.	It is not important for us because we know how they think. They don't understand how we think.	(1)The wrong support is send over. (2) we just explain what we do as if we're explaining a child			It a big challenge but not a big problem	It is mostly an issue for the relationship. It doesn't help if you have those discussions that you have to straighten out.
Solution	Customer gets an independent trusted advisor who has the same background							

Contextualization issues

Context can be defined as information about: the situation, intentions, and feelings about an issue or action. Losing the context of information can be an issue. For example if the distance between two objects is 14, it is good to know if this is in cm or in inches.

M	1	2	3	4	5	6	7	8
Example		-		Partner installed CAT5 while we needed CAT6	Partner does not understand why I have a problem with a situation	A customer gave specs in 1mm, but our systems works with 0.5mm		
Example #2		-						
W Example		-					sometimes there is a misunderstanding because everyone adopts a different context	When things then don't go as fast or as well then it is interpreted as incompetence or lack of commitment. Instead of that there is someone on the other side of the mail who's also trying as best as he can.
imp value		2		3	1	2	1	2
importance		You have to be able to put information in context. Just a mail in itself is not useful		Who pays for the mistake?	Not a big issue	We had to start over, otherwise customers would get the wrong output	the problem can always solved with communication	it does not benefit the collaboration.

Semantic issues

Use of different terminology or meanings of words can cause misunderstandings.

N	1	2	3	4	5	6	7	8
Example	abbreviations	Terms have very wide ranging definitions. Everyone has its own perception of these terms. We constantly have to try to align these definitions.	The definition of words varies amongst customers	Customers don't understand the technical terms of our partner			Differing definitions makes people think they are on the same page when they are not	
Example #2							Does 'revenue' include VAT or not?	
W Example		everyone has their own way of describing and documenting things						
imp value	1	3	3	1			3	1
importance	solvable, just ask	If some kind of container-term is used to give direction, people will do the wrong things	Collaborating is a social psychological process, people have to understand and trust each other.				otherwise you're not on the same level of knowledge, you don't share a common understanding	No I don't think this is much of an issue.
Solution			send a consultant or an IT guy along to be present at conversations, to clearly translate				an information-model, some kind of management-model and next to that a number of data definitions to which everyone can conform	

N	1	2	3	4	5	6	7	8
internal					Communicating with our IT supplier	We have a translation table for the exact definitions of words		
imp value					1	2		
importance					I can manage	Those words are used to determine the amount of supplies we need		
solution								

Organizational issues

The organization does not have sufficient formal planning, guidelines or regulations for knowledge sharing. Making it unclear who is responsible, what should be shared and how it should be shared.

O	1	2	3	4	5	6	7	8
Example		No formal guideline (yet) for documenting customer contact	Compliance to guidelines	Customers don't know who to ask certain questions	-	-	knowledge sharing is not organised or very limited	No power hierarchy in the network
Example #2			Customers have multiple locations, difficulty realising a user group					Network members were unaware of the process required for our product.
W Example	difficulty to make hard agreements	Partner has an internal conflict due to direct sales and indirect sales						
imp value	1	1	2	3	-	-	3	3
importance	You have to and we do, I'm not so afraid of it.	everyone is expected to be commit to get the most out of every contact	Risk losing valuable knowledge	time is lost, costs are made and discussions with customers	-	-	If you don't organise you are dependent on a small group of people that share knowledge.	People cannot be forced to spend time on joint activities.
Solution								
internal						people are a single point of knowledge		
imp value						3		
importance						danger to continuity		

Lack of top management commitment

Due to lack of top management commitment and involvement, knowledge sharing initiatives lack mandate, causing it to fail.

P	1	2	3	4	5	6	7	8
Example						-	I have never encountered that a customer had a clear vision on knowledge sharing in their organisation	Some members of a part of the network are told by their employer that they should not put any time in network efforts.
Example #2						-		
W Example					New initiatives in the network don't get off the ground	-		
imp value					1	2	2	3
importance					If there is no commitment it stops. Business as usual	If no attention is payed to knowledge sharing you run an irresponsible risk. If knowledge is not shared and someone drops out that knowledge is gone.	A clear vision on knowledge sharing can improve efficiency and competitive advantage	It slows everything down. It regularly causes delays.
internal	when a decision is postponed it creates uncertainty	The degree to which a manager believes in documenting knowledge is reflected by his department						
imp value	3	2						
importance	Efficiency suffers, not focussed on one goal. People enjoy clear goals and structure	information is crucial, it costs us business if we are not up to date with the current state of affairs with customers						

Network level objective and benefit issues

Organizations do not understand the network objective or they do not equally benefit from the network objective. Making them less eager to participate.

Q	1	2	3	4	5	6	7	8
Example	People don't see the potential of collaboration			Partners are open to suggestions but must know the costs and who else could be interested	Partners feel they don't benefit as much as us		it is important to have a clear definition of the business value: 'what is in it for me'	Politics, everyone has their own interests. Sometimes they work against each other
Example #2								
W Example							Collaborations are opportunity driven, everyone goes for their own gains	
imp value	2			1	1		1	3
importance	a healthy issue, forces you to be better and try to get the best out of combinations				This is only an issue at first		Business value is easy to detect, if there is none I exit.	So many individual interests that the joint-goal is lost.

Insufficient resource

Lack of resource in different types such as lack of expertise, training, time and funds cause difficulties for knowledge sharing.

R	1	2	3	4	5	6	7	8
Example		the risk of knowledge remaining in your head due to time documenting requires		Customers call for help so much that giving training to them is cheaper			No resources to collaborate with everyone that approaches us	Coordinating efforts in the network happen on voluntary basis, parts of the network don't have the enough time available.
Example #2		Time availability for documenting conversations					(2) We specifically look for knowledge workers in a network. There are not enough of them	
W Example					A general lack of time	In the network we're all fishing in the same pool of people with the right knowledge		
imp value		3		1	1	1	3	3
importance		Especially as a small organisation you try to do as much as possible		we have a solution		Our employees are being pulled by other companies	(2) Sometimes customers rely on people with the wrong knowledge and make themselves dependant on weak partners	slows everything down
Solution				customers have to pass an exam before they can get a certain role				

R	1	2	3	4	5	6	7	8
internal	we want to develop more than that we have time and people for		(1) capabilities of people, especially in IT, how do you get people and (2) Where to find partners to fulfil a temporary demand	It is hard for employees to find time for training		The composition of your workforce		
imp value	1		3	3		3		
importance	This is just the game they call running a business.		(1) The only thing we have is the knowledge of our people. (2) If you can't find the right partners it can cost your own people a lot of effort.	It is a very important issue because it is all about knowledge here		New young people are more willing to share and inspire older people to do the same		
solution								

Organization structural issue

There is too much hierarchy and centralization or there are too many guidelines and regulations, causing inflexibility. People might be willing to share, but lack the authorization.

S	1	2	3	4	5	6	7	8
Example				Directs have to pass through 3 parties			In customer-organisation management layers are not knowledgeable about what happens in the operation layer. Only a small number of individuals have the power to create cohesion	
imp value				2			1	1
importance				mistakes are made			In the network this is less of an issue, in the network there is a lot less hierarchy	Hierarchy is quite limited in networks. I think you'll find that more inside of organisations.

Lack of incentive

People are not motivated to share their knowledge due to lack of incentives, in the form of accolades or rewards.

T	1	2	3	4	5	6	7	8
Example		individuals that work for partners are rewarded more for direct sales than indirect sales						
Example #2								
W Example								
imp value		1						
importance		-						
Solution								
internal		Some people over here do not document enough and we don't do enough after observing that						
imp value		2						
importance		you could miss opportunities						
solution								

Authorization / data access

Data exists but it is not mobile. People cannot access it and therefore they cannot derive value out of it.

U	1	2	3	4	5	6	7	8
Example	data from customers is classified	-		Sometimes customers don't share new developments.	(1) When a customer had an issue with a partner and the partner never informed me			Documents are stored, but customers are not given access to them
Example #2		-		Customers don't give updates when people die or contact information changes	(2) Booking cancellations from customers are not communicated with partners			
W Example		Some older customers don't know what we are capable of these days (marketing issue)						
imp value	2	1		1	3			1
importance	more authorisation makes it less important	If you can't access data then you can't use it, missed opportunities		Not able to anticipate	(1) I end up in the middle and don't know who to believe. (2) if it doesn't happen to often it's not a big issue			It is important for that network member, but not for the network itself.
Solution				Automated connections	(2) Adapt the process, every outgoing revenue stream has to be matched by an incoming one			
internal						Some data was only accessible with two licences and software had to be installed on a particular PC		
imp value						1		
importance						we no longer need that data		

Performance measurement issue

Without monitoring control and evaluation procedures it is impossible to tell how KM system is really performing.

V	1	2	3	4	5	6	7	8
Example		-						There is data, but no evaluations are done. There is an attitude of 'as long as it going fine... it's going fine'
Example #2		-						
W Example		-					Once you define what data has to adhere to you can measure it to assess the quality	
imp value	1						2	2
importance	As a route cause analysis supporting the question 'why isn't it working', it is important.						It is related to data quality	Well I think the organisation could become more professional. But I think it only really becomes a problem when things really go wrong one time.

Legal issue

Laws and regulations may put constrains on inter-organizational data sharing.

W	1	2	3	4	5	6	7	8
Example	NDAs		IP rights	We have to identify callers and we are not allowed access to all data	Privacy laws	Production data has to be anonymized before testing	We can only exchange data with customers if we sign contracts, it creates "waste"	
Example #2						Legal issues with digitalising data		
W Example								
imp value	1		1	3	1	2	2	
importance	something I got used to		I'd rather develop patents without them being patents than that I spend money on it.	it becomes more difficult due to laws	If I'm not allowed to share some information I don't do it	When things that can literally save millions per year can't be realised, then it is a problem.	It depends on the branch	

Failure to meet technological demand

Technology in place is inadequate to support actual business processes.

X	1	2	3	4	5	6	7	8
Example						For a particular problem we can't use our partners technology		
Example #2								
W Example								
imp value						1		1
importance						we outsourced it		That shouldn't be a problem. For everything it should be possible to find a solution
Solution								
internal		No system for contract management. Or a full customer overview						
imp value		3						
importance		Customers could be lost						
solution								

Lack of user-friendly IS

The system is not user-friendly enough.

Y	1	2	3	4	5	6	7	8
Example	new system has so many options that there is a learning curve	-						
Example #2		-						
W Example		-						
imp value	2	1						1
importance	if there would be less options they would be missed	it helps with the adoption and acceptance of technology						This is a solvable issue

Data quality issues

Data quality issues refer to availability, accessibility, accuracy, privacy, and completeness of shared data.

Z	1	2	3	4	5	6	7	8
Example	-	Completeness, how do you know what is relevant in the future. What do you document and what do you leave out		incomplete data entry causes issues in reports		When these issues occur we can get printing errors	Ideas of managers are not possible because data is not present or of poor quality	
Example #2	-	Data is time bound, knowledge ages, technologies change, organisations change, customers change.						
W Example	results of systems had to be shared and the customer was not satisfied						Defining what data has to adhere to, allows assessment of quality	
imp value	1	3		1		2	3	2
importance	easy to solve via internet	It is important because you think you are looking at something, but in reality it no longer exists		We are called upon mistakes in reports		We can't have that because that means customers get the wrong data.	If your quality is poor it costs you money because you make wrong decisions.	I think that at the moment we want to do more analysis, we'll find that we can't get the information we want.
internal					Matching export files with the data in books			
imp value					1			
importance					it is difficult			

Data overload issue

There is more data available than that there is processing capacity available.

AA	1	2	3	4	5	6	7	8
Example		-				During a process all kinds of things are called upon and the data explodes	-	
Example #2		-					-	
W Example		-	Multiple customer locations can't produce a single question for specs				-	
imp value		2	3			2	1	1
importance		Inefficiency, if people can't find things they start inventing the wheel again				It could force us to choose which type of customer we serve	we have so much processing capacity that we can just handle all data	No, I don't think it is important
Solution								
internal	A month of data is heavy for a real time system					A system blows up data.		
imp value	1					1		
importance	customers want results in time					It has been solved. But, It could force us to choose which customer group we serve on time this year.		
solution								

Data security issue

Because of technological issues data may not be sufficiently protected.

AB	1	2	3	4	5	6	7	8
Example			-				People overreact and they seal everything, so that they can't even access their own data	Customers get a code to login to the system, if they know the URL they can also login from uncontrolled environments.
Example #2			-				Some data might have to be authorised in some way that might not be technically possible	
W Example			Don't dare saying anything about it, because that would imply a break in and then we would have had a very serious problem.					
imp value		2	3				3	2
importance		It is a balancing act between: are people allowed to see, want to see and can they see.	We register sensitive information, a break in would be all over the newspapers				The playing field of security is becoming more complex and more strict	In practise the issue it not severe. Work processes are organised in a way which makes abuse difficult.

Data integration issue

Different information systems are not capable of exchanging data.

AC	1	2	3	4	5	6	7	8
Example			One system is not able to store a second registration before it is connected to another system	We want to integrate systems to deal with changes in the dollar exchange rate		Integrating systems with tax authorities	Some customers want a 'gold record' of their customers while some systems use different identifiers for customers	Connection between systems are limited. Often it has to be done by hand.
Example #2								
W Example								
imp value			3	1		3	3	2
importance			It causes incorrect information	Sometimes prices change and it affects our margin		things can be done smarter	It is about the data that is registered in the process. That is what you act on. It can be very expensive to solve integration problems	I think we could win time but I don't think it's a very big issue.
Solution							by thoroughly thinking about this at the start you prevent these issues later down the road	
internal	integrating CRM with email	Integrating CRM with support management system					Disjoint datasets among different locations of customers	
imp value	1	1					3	
importance	always solvable	So far it has not caused big problems					if they want to see 'what do we do, in that category of products' then you can't add it up anymore	

Too many communication facilities

AD	1	2	3	4	5	6	7	8
Example							We have so many channels that we have to formulate a policy for what we put on which channel.	
Example #2								
W Example								
imp value							3	2
importance							Because people (A) 'I want to communicate this but what channel do I use?' So that is a consideration. That you don't know it anymore 'what is the best channel?'. (2) The receiving side: 'does he keep track of all those media?'.	I notice that, especially if problems occur you have to be able to find the source of the problem. If you have more channels, you have to search longer. It becomes more complex.

Appendix F KTI framework comparison

This appendix describes the limitations of related frameworks and provides and a short discussion which clarifies and gives an explanation for 'why' the related framework differs from the KTI framework.

Limitations of (Duan, Nie, & Coakes, 2010): The main categories of Duan, Nie & Coakes (2010) define where issues originate from. General issues and Technical issues are not mentioned (the most technical issues refer to ICT as a communication option). The framework of Duan, Nie & Coakes (2010) focusses strongly on tacit issues. The scope on Organizational aspect issues and language / understanding issues is also smaller.

Discussion: Duan, Nie & Coakes (2010) has a focus on the 'lack of mutual understanding' subcategory. The categories that are included in the framework are of a lower abstraction level.

Limitations of (Lin, Wu, & Yen, 2012): A narrower scope of sub-categories and a lower abstraction level.

Discussion: Emphasis is put on *lack of mutual understanding, organizational issues* and *lack of willingness.* This can be explained due to the fact that Lin, Wu & Yen (2012) is focused on barriers to knowledge flow.

Limitations of (Pirkkalainen & Pawlowski, 2014): Focus on barriers for social software connections utilization. It has a broader scope in the sense that it is not limited to VNs, hence less emphasis is placed on issues that occur in network settings. Some issues that can be relevant in VNs such as *network complexity* are not mentioned.

Discussion: Pirkkalainen & Pawlowski (2014) focus on barriers related to knowledge management, in particular knowledge exchange. The subcategories are of a much lower abstraction level. In particular: lack of willingness.

Limitations of (Hong, Suh, & Koo, 2011): No attention is paid to technical issues; a people driven approach is employed. The main categorization is based on who is experiencing the issue and not so much on what the issue itself. Sub-categories focus on the type of issue and are of a similar abstraction level. However, the scope of the issues that are discussed is much narrower.

Discussion: Hong, Suh & Koo (2011) focus on knowledge sharing barriers. Although the abstraction level is similar to the KTI framework the scope is narrower. The focus is on tacit issues.

Limitations of (Paulin & Winroth, 2013): The framework focusses on factors that influence knowledge transfer, sharing and flow. Little attention is paid to technical issues and sub-categories that might be relevant for a VN context are also not included.

Discussion: The framework presented by Paulin & Winroth (2013) defines facilitators, inhibitors and obstacles. For comparisons, not having a facilitator is interpreted as an issue in the KTI framework. For example: "IT systems" is listed as a facilitator. Lacking this facilitator could be interpreted as *failure to meet technological demand* (this is the only technical issue mentioned).

Limitations of (Haug, Stentoft Arlbjørn, Zacharissan, & Schlichter, 2013): Categories such as N*etwork structure issues*, *generic issues*, *social issues* and *language / understanding* issues are not addressed. However, the sub-category 'organizational issues' is of a lower abstraction level.

Discussion: Haug, Stentoft Arlbjørn, Zacharissan, & Schlichter (2013) focus on what causes data quality issues. This causes emphasis to be put on explicit issues.

Limitations of (Howard, Vidgen, & Powell, 2006): the focus is on inter-firm barriers (B2B) to adoption of e-hubs and to information exchange. The scope of issues included is much narrower and the abstraction level is lower. The focus does not include issues related to *Generic issues* or *language / understanding issues*. The framework only includes one sub category of*: Network structure issues* (network complexity) and two sub categories of *Social issues* (Lack of willingness & trust).

Discussion: The emphasis on in Howard's framework is on barriers to adoption of e-hubs. This can explain why a lot of issues that are related to ongoing processes are not mentioned.

Limitations of (Yang & Maxwell, 2011): The framework focusses on both tacit and explicit issues. However, it is not stated how the framework was build. The scope is narrower; the KTI looks more elaborately at issues related to data or VNs.

Discussion: Yang & Maxwell (2011) focusses on governmental information sharing, this can explain why the more 'network related' issues are omitted. The main categories divide the sub-categories in inter- and intra-organizational issues.

Appendix G Delphi study

The fields that are marked green in Table 6 and Table 7 have been selected for the Delphi study. The selections were made based on seven interviews as there was no indication that there would be an eighth participant added at the time. The tables that were used for this selection are included in appendix D, accompanied with a concise reason for each KTI, why it was or was not selected for inclusion in the Delphi study. The pilot of round one was conducted with an uncle of the author whose organization is active in a network environment, but does not emphasize the needs of customers. The pilot interview lasted 45minutes.

Delphi protocol round one

The Delphi protocol of round one contained an introduction with the research outline and after then ten pages. On these pages the definition of the KTIs were stated and the examples given by the experts during the multiple case study. The statements were given shown in the form of tables as is shown in Figure 33 (not including the orange fields). The KTI included in the protocol were:

1. Complex network issues
2. Lack of willingness
3. Insufficient mutual understanding
4. Semantic issues
5. Organisational issues
6. Insufficient resources
7. Authorization / data access
8. Legal issues
9. Data quality issues
10. Data integration issues

Delphi protocol round two (and results round two)

This section presents the Delphi protocol. The Delphi protocol was used without the importance indications (such as [4(1)]). Is also did not contain the participant numbers in the 'rationale text boxes'. These are part of the results.

_____

This interview is the second round of a 'two round Delphi' study. The goal of the study is to find solution types for previously identified Knowledge transfer issues. The Delphi study can be viewed as a structured brainstorm session.
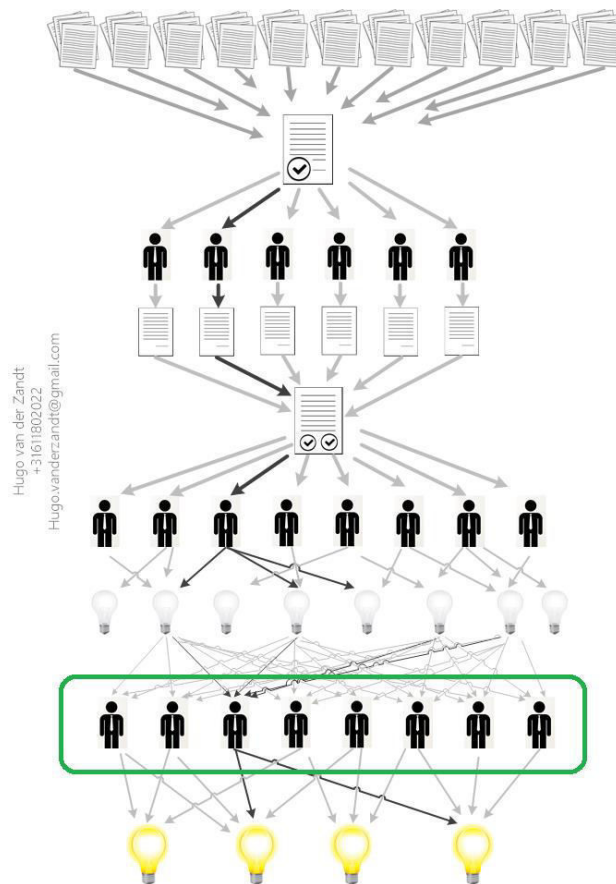
In the second round you'll be asked the following for every issues:

1) Do you recognise your own suggestions in the mentioned solutions?

2) Do you think that the other mentioned solutions are useful ?

3) Which of these solutions do you find most important?

4) After seeing the other ideas, do you have additional suggestions for ICT functionalities?

4b) why do you think that this functionality is useful?

At the end of this interview I would like to close with a number of question about this research in general. After this interview I'll send you a report and once the second round of the Delphi study has been finalised I'll share the results.

Complex network issues

Functionalities:

c2 [8(4)]A shared online environment with:

- c3 [8(7)]Documentation about:
    - Progress,
    - Agreements,
    - Things that are said
- c4 [8(5)]Layered authorisation
- c5 [6(3)]Messages
- c6 [5(1)]Polls
- c7 [6(1)]Ideas
- c8 [6(2)]Version control
- c9 [6(2)]Define tasks
- c10 [5(3)]Calendar functionality
- c11 [5(3)]Appointments
- c12 [7(4)]Forum functionality

c13 [7(6)]Electronic conferencing

- c14 [8(5)]Seeing and talking with larger groups
- c15 [7(4)]Whiteboard functionalities
- c16 [3(1)]Polls

c17 [6(3)]Connecting systems with good standards

Rational:

4Everyone has access and authorisation can be layered. We have positive experiences with this

2The sharing of knowledge becomes much easier. There has to be a goal and a definition of the role of the partners. You can think upfront about how you'll organise authorisation. With ICT this is easier than with people.

5(Bitrix24) This creates more structure, then you can also find things back. If you don't have anything it doesn't work, then you have to use

6Efficiency. Everyone: saves time, can join in faster, can answer at convenient moments. No more need to be physically together. Another advantage is time-to-market, because with that you can rapidly make agreements.

3For an issue such as complex network issues you have to get together and discuss it. If multiple disciplines are involved multiple disciplines have to speak because it is a multi-disciplinary-problem. If everyone is too far apart it is too expensive and time consuming to travel.

5It only works if you're not close to each other. You have less travel time, it is more efficient. So you can have more meetings.

8It makes it possible to share information between systems and parties. But the feeling that those systems contain sensitive data, that you share with a competitor, you don't remove those just like that.

Functionalities & procedures:

c18 [7(3)]Carefully look how you can use available ICT tools. If you're still missing something than you have to acquire and add it.

Rational:

7These days you have to tailor how you communicate to keep everyone on board. Young people for example are easier to reach through whatsapp-like media. They are less used to work with traditional means such as email. If you only use email you're going to miss people.

Lack of willingness

Functionalities:

j19 [7(4)]A knowledge matrix (excel file)
In this matrix it is shown what the knowledge-levels should be: how many people know it and how well they should know it. Next to that what the reality is. This gap can be used as a KPI to steer on.

> *6Teams can start working themselves: if we have to do this job, then we need this knowledge, then we have to make sure that we build that knowledge. That's why it is useful, if this succeeds then it secures my continuity and my stability. The customer benefits from this because the systems become more reliable. If there is ever an incident I have the knowledge in house to solve it.*

j20 [7(2)]Mind map techniques
With brainstorm sessions. Ask people up front to provide input and then build a mind map.

> *7Mind Mapping is an accessible way to collect input from everyone and also to structure and organize input. Everyone can watch it grow and thereby be triggered to add something.*

j21 [4(3)]A shared central environment:

- j22 [5(3)]Everyone can see each other's input

- j23 [4(2)]Options for gamification
  Give points for adding knowledge

- j24 [4(1)]Everyone can ask anonymous questions

> *2With this you'll remove any inequality and you'll introduce openness. But if people don't want to share you won't solve the problem with that. Then you'll have to use other things.*

> *5Then people are opener. It gives them the feeling that it can't be abused. But if it concerns an individual that doesn't want to share knowledge then you have to address him, confront him about it.*

- j25 [6(3)]With standard contracts (e.g. NDAs) options can be selected electronically

> *1You already solve the issue with an NDA, with ICT you can make it more efficient. If everyone uses the same formats of documents you don't have to go through them every time.*

Functionalities & procedures: Rational:

j26 [6(3)]Avoid custom-made solutions
Use standard solutions such asmacros from office

> *4We think that it gives competitive advantage. Should a customer leave us, then you prevent discussions about who is owner of what. We don't gain anything either when a former customer keeps calling us with questions about how things work.*

j27 [8(5)]Forum functionality
A place where everyone can see each other's questions. Next to that make sure that only questions that are asked there are answered. It takes more than just ICT, You'll need some policy too.

> *advantage of doing it digitally is that it remains. Like that you can build some kind of database of information. You can also have monthly meetings, but then after that meeting it is gone.*

j28 [8(5)]**Get everyone around a table**
Go out for dinner and don't talk about work, build a trust relation.

> *3Because this is about trust and someone that I do not know, I don't trust. In this way you can create that trust.*

Insufficient mutual understanding

Functionalities: Rational:

l29 [6(3)]A central environment:

- l30 [6(2)]In which definitions are stated
- l31 [5(3)]Context is stated,
- l32 [4(3)]State what something means for you

> *2In can create a context. But people will still be needed for the compensating for the differing background-knowledge, education, experience etc. I think this often requires a human touch. To make a translation between a HR employee and an IT guy.*

- l33 [6(2)]A document management system
- l34 [4(3)]Asking and answering questions which people can look at.
- l35 [5(2)]Blogging about what people do and how that goes.

> *7People can inquire such a platform at all times. If others are at home you can still proceed if you need help. It is also patient, everyone that is new can read that information and absorb it. It is very efficient.*

- l36 [4(3)]Explaining what you do and why you do it (as if explaining a child), to make the higher purpose / added value clear.

> *6This way you can get clear why the other does something and you can act accordingly.*

- l37 [5(1)](on a site) stories of how everyone works

> *8If it is used you can create understanding for each other's background. People do have to do something with it, it has to start living. Het will depend on the network, but if it is used it can be useful.*

l38 [6(3)]Use linked-in if it is within the network.

> *5Then you can see where someone comes from, what he does, which relations he has etc.*

Functionalities & procedures: Rational:

l39 [5(2)]detailed lists with questions.
It is important to keep asking your customer questions until you know what the need of the customer is. This can be supported with a digital list of questions. You can share this list in phases with your customer, this way the customer won't be scared off by too much information at once.

> *1Then you understand what the customer wants and you also understand the situation. But you also have it on paper. So if afterwards it is not correct you can refer to earlier statements.*

l40 [7(5)]Reference visits.
Taking a new customer along to an existing customer. On such a visit you try to bring as much people from different layers along. This reduces ambiguity. People get the same background like this. Like this it is also clear to the customer what they are going to get.

> *4Reference visits have proven their value in the past years. In this way it becomes tangible for the new customer what we can do. You do have to visit fitting existing customers, they have to be comparable.*

l41 [7(5)]Get to know each other in an informal setting.

> *3Out of personal experience I know that it works like that.*

Semantic issues

Functionalities:

n42 [8(5)]A spellcheck on potential semantic issues. That it is brought to your attention if there could be misconceptions around terms.

> *1The biggest danger is when the issues are there but you don't know it. If you know it you can discuss it and create clarity.*

n43 [8(6)]The making of good documentation about what there is and how it is linked to each other, infrastructure, applications, databases, processes, functions.

> *7You need to have certain things in order. An architecture is built on an infrastructure. You need to describe that. The system supports processes and those again have a relation to the data. Hitting certain functions. There are so many dimensions. There is tooling available for this (case-wise, QPR, ARIS).*

n44 [5(4)]A wiki functionality, well documented definitions. Make giving feedback possible, then you can also keep adding to it so that it becomes more complete over time.

> *8Because looking up terminology is relatively easy to do. I think that if you build is in such a way that it is easy to add things, which it doesn't even have to be a big investment. You can maintain it and let it grow over time. But it will depend on the network whether or not it is actively used.*

> *5This will only work if you have a proactive attitude towards it and really use it. Then you can refine definitions too.*

n45 [7(3)]A FAQ, on for example a portal.

> *4Documents with agreements are often large unmanageable documents, a FAQ would make searching easier.*

Functionalities & procedures:

n46 [5(3)]A list of words with definitions that is organised in such a way that everyone has to use it. That you can see if everyone has opened that document or has used that functionality. Or that the list pops-up when someone logs in.

> *2Like this you can create a common ground around terminology, as part of the information exchange at the beginning of a collaboration.*

n47 [6(3)]A process agreement, where if after three emails something is still not clear you have a video chat then you also see the non-verbal.

> *6Because you can react very fast, you can also hear someone's intonation and body language. That is a lot clearer than written text.*

n48 [7(7)]Improve the trust relation, don't be afraid to ask each other questions.

> *3I have positive experiences with it.*

Functionalities: Rational:

o49 [6(5)]A wiki for the network. In that processes and terminology can be described and SLAs can be documented.

> 6Then you lose the interpretation differences. Everyone looks at the same thing so it should be clear. If you then notice that it is incomplete you can easily made that clear.

o50 [6(5)] Establish a Products and Services Catalogue (PSC): what we are going to deliver, at which moment, with whom. This way the customer knows what he'll get. For example of something comes with an SLA or not. Also little movie-clips can be used for clarification.

> 4This way it is clear what the agreements are. With a PSC you prevent discussions with customers about unclear things.

o51 [5(3)]The documenting of previously defined guidelines, in such a way that everyone can access them.

> 5Then it is clear what the guidelines are.

o52 [7(5)]Documenting what has been communicated, meeting records, in some kind of dataset. Where the involved parties have access to the database. Then later on it is still clear who brought which idea forward.

> 1It makes communication easier, more efficient, explicit and clear.

o53 [8(3)]A project management system in which you define tasks. In which is stated: what the problem is that you want to solve and what the criteria are for solving it. This will be placed in a backlog. To this you can then assign priorities. This way everyone with access to the system can see what has to be done.

> 3This way you can solve issues. Without this proof, you'll keep friction. Then it remains subjective 'that was my idea, no that was my idea'.

Functionalities & procedures: Rational:

o54 [5(2)]IT can provide the building blocks for a policy: these are the users that you have, this is the content that you have and these are the departments and roles that have already been defined.

> 2It can provide the pieces of the puzzle that enables people to formulate a policy. You have to think about that information, how you organise things such as authorisation. But with this organising itself ICT does not fulfil a part.

o55 [6(4)]ICT can help with mapping the network, with this you can then make a planning.

> 8I think that a lot of people, especially with project, do one-off things. If you are then helped with certain formats, the chance that you start forgetting things is smaller.

o56 [8(7)]Include in a policy how IT is supposed to be used for knowledge sharing activities. This policy has to be documented on a place where people can access it.

> 7IT is actually the platform where people can synchronously, but also asynchronously, find and receive information. Together, with the aid of IT you create a kind of company-memory that consists out of multiple tools.

Insufficient resources

Functionalities: **Rational:**

r57 [7(6)]A service desk system (Top Desk). In which it is digitally established which products a customer has with a serial-number. The customer can also register problems himself

> *4If a customer calls we know exactly which product is concerned and where it is. With a service desk system you can see what the peaks are: if a particular customer has more problems with a particular product.*

r58 [7(6)]A shared environment

- r59 [6(3)]Chatting
- r60 [5(2)]Video calling
- r61 [7(6)]Sharing documents with
  - Knowledge
  - Agreements
- r62 [7(4)]Making it posible to find knowldge (of employees)
- r63 [7(4)]Best practises
- r64 [5(3)]Answered questions
  - When asking questions make it clear if the question has been answered (correctly) before, or what the incorrect answers are then you immidiatly have a huge amout of context available that you would not have been able to find in traditional environments

> *6Then you have everything together, your communication, your storage (which is also a form of communication) and that is also a piece of efficiency. You can reduce travel times with such a platform. You keep the work more collected. Then everything will also run smoother.*

> *2If something costs X time, and after you implemented such a system it will cost less time, then it helps me. Better even, I think that you can find more information than before in less time. Because back then information was located in unreachable information systems.*

> *8In the long run it often saves time and money.*

r65 [7(3)]E-learning (for training). You make it once, videos, short texts and questions to practise with.

> *3It helps with removing the travel time*

r66 [7(6)]Electronic conferencing.

r67 [7(5)]Interactive studio

> *5It only works if you're not close to each other. You have less travel time, it is more efficient. So you can have more meetings.*

- r68 [6(3)]Seeing and talking with larger groups
- r69 [6(3)]Whiteboard functionalities
- r70 [5(2)]Polls

r71 [7(5)]ICT which enables you to easily create a flexible workforce.

> *1Then you can add more people when needed. Hiring more people is not always an option, there has to be more coming in than there is going out.*

Functionalities & procedures:

Rational:

r72 [3(1)]Every once in a while give employees a short quiz about important themes. Do this digitally so that it can be corrected automatically

8Like that you can see of what you have enough knowledge and what the next question should be. The idea behind it is also that people are triggered to look for the answers together. Like that you can share knowledge without spending a lot of money or resources.

r73 [4(3)]When lacking time for partners, hire new people and delegate.

5Then the problem is solved.

Functionalities: Rational:

u74 [5(3)]One central system in which you share knowledge.

- u75 [6(4)]Notifications of changes/modifications
- u76 [6(3)]Ability to comment on tasks
  (a logbook functionality)

> *5Then you know what the current state of affairs is.*

u77 [5(3)]A knowledge repository

- u78 [4(3)]Exchange knowledge and document it
- u79 [6(4)]Very good authorization security. Everyone

In the network works with the same system but
can't all read the same information. Then you
can discuss certain subjects and people which
it does not concern can't access it either.

> *3Then you have everything documented immediately. This gives the freedom to exchange information in such a way that you prevent getting into a quarrel.*

u80 [4(3)]Link contact information

- u81 [3(3)]Contact information could be linked to public
  information sources (Linked-in). ICT can track
  for relevant changes in contact information.

> *8It is hard to actively check that yourself, it has to go automatically. We check once a year but that is actually not enough.*

u82 [5(4)]ICT can assist in achieving a quality standard (ISO).

u83 [6(2)]Tools that enable working and the sharing of
data remotely, through email, video conferencing or
digital reports.

> *1If you're allowed to have authorisation it can be arranged. If you're not authorized to access something ICT does not have a solution.*

Functionalities & procedures: Rational:

> *7Data availability was an issue in the past but it no longer is these days. Things such as communicating changes is a peoples-job, it concerns the willingness of people to share. You are able to use ICT aids for this.*

u84 [7(4)]Maintain a good relationship

- u85 [7(6)]You get information about changes over at
  customers through maintaining a good relation.

- u86 [6(4)]Monthly contact with customers

- u87 [7(3)]ICT can help with making SLA reports.
  Ask customers if they want to discuss
  the report.

> *4A good relationship improves the collaboration.*

- u88 [6(3)]Once a month, take the time to report
  organisational changes to partners.

> *6Then it is not forgotten. But I have the impression that the real important stuff reaches you regardless.*

Functionalities: **Rational:**

w89 [5(3)]In a shared platform.

> *6Just to create understanding.*

- w90 [8(3)]Placing links to sites that explain laws and regulations

> *2Information is always shareable if people really want it, no system is waterproof. So you have to enforce that people don't do that with policies and penalties.*

- w91 [7(5)]When someone logs into a system for the first time he is shown an agreement which he has to accept (promising not to share information with other parties).

> *8It helps you to follow the laws and regulations. Often laws and regulations are easy to automate because it are a kind of cause and effect steps that you can define. If you leave that to people the chance on mistakes is much larger.*

- w92 [7(5)]Authorisation: data that may only be processed by certified people can also only be processed by the correct people.

- W93 [6(3)]Automatically organise retention periods.

W94 [7(4)]As a complement to a non-disclosure agreement (NDA). A kind of closed environment in which others can work with provided information, code or executables. In which I can pull back all information in the push of a button. I don't have the solution, but I do have the functionality.

> *1With this you can protect certain information.*

w95 [6(6)]A legally binding way of singing documents online.

- w96 [6(6)]In which you are able to see if the original document has been modified.

> *5Then you don't have to use paper. It saves a lot of time and is also legally binding.*

w97 [7(5)]If you are allowed to share data you can use ICT to protect it.

> *7ICT is developed to such an extent that the law prescribes it. But where it is not allowed, it is not allowed and therefore you're not going to do it.*

Data quality issues

Functionalities:

z98 [7(5)]Retrieve data from live systems.

z99 [7(4)]Reports with information from multiple systems.

z100 [5(3)]Analictic scripts that remove homonyms and synonyms from data. Assuming that everyone has the same data with different content. Or differences in new and old files. During development you check if the data that you have is actually matches.

z101 [8(5)]A tool that checks whether the data meets the demands of the customer. With for example a format check or a check which uses user-provided manual measurements.

Input:

z102 [7(7)]Enforcing that the format of data is correct. (The content is more difficult, a typo for example)

z103 [7(5)]Arranging that certain field have to be entered (masks).

z104 [8(6)]The automatic entering of data, for example street names when entering a postal code.

z105 [7(6)]Checking if input is correct (email addresses).

z106 [6(4)]Data-definition tools, systems to jointly work on data definitions.

- z107 [3(3)]To which everyone has access and
- z108 [3(3)]Is able to modify things (collibra).

Functionalities & procedures:

z109 [7(5)]Data management procedures. Appoint data owners and Data Stuarts, people who are handling data and solving problems on a daily basis, in order of the data owner.

z110 [7(5)]Make agreements about what kind of format the data has to have and which quality targets it has to adhere to.

Rational:

4In this way as little use as possible is made of aged-data.

3Like this you can for example remove mistakes such as: Miss Jansen is married do sir Pieterson and is now listed twice in the database. These kinds of mistakes are

1Then at least you have that clear between two parties, what the expectations and demands are. And you also have a quantitative method to verify it.

8It works to a certain extent, you force someone to put information in it. But if you push it too far you also get that people start to enter nonsense.

2Because a system is not capable of judging to coherence. Entering 5meter if it has to 6 is a big mistake, but you're only one key wrong.

5If you don't do this it will become a mess for sure. If you enter dd-mm-yyyy when it should be mm-dd-yyyy then it becomes complicated.

8It makes it easier.

7Bad data costs money, we call that the cost of non-quality. If you don't have that sorted then you can even get damage to your image.

Rational:

6If you do this upfront it works well.

Data integration issues

Functionalities: ### Rational:

ac111 [8(6)]A translation table between systems.
The fields of the table remain the same. The partner fills
it and we read it. If the partner changes something
they have to start filling it differently. That does not
influence our system. Like this you create a common
communication platform.

> *3Like this it costs less money. Otherwise the maintenance of connections becomes very expensive. When one side is affected by changes on the other side.*

ac112 [6(5)]Connection hubs: something that you place
between two systems that solves the problem for you.

> *2Because systems are always connectable. With IT is digital information always accessible. You just have to wonder if it is useful.*

ac113 [7(5)]Conversion software or connector software that
makes systems interoperable. That data is translated into
something which the other system understands.

> *1Well it just exists and it works. Sometimes the connectors are not available but those can be made.*

ac114 [7(7)]A bus on which all systems are connected. All the
data comes together there, this makes it
possible to make reports.

> *4This way the customer can be provided with steering-information. The customer real insights. They don't trust you on your blue eyes anymore.*

ac115 [7(7)]A bus takes that from a source and puts it on
a channel, everyone can take it from there

ac116 [8(7)]APIs, aids to get into a source

> *7That is our profession. We connect source systems, retrieve data and build data warehouses. You need a lot of technologies for this. It is completely interconnected.*

ac117 [7(5)]Extraction, transformation, loading (ETL) tools for
the reading of databases. Such a tool can retrieve
data, manipulate it or enrich it and store it again
in a receiving system.

> *6The advantage is that you can communicate. Just make sure that only one system is used for registering new things, so that you transfer to one system. Then you really solve the problem.*

ac118 [8(5)]Interfacing, a translation process
between two systems.

ac119 [8(5)]Single-sign-on
A system makes a certificate with which
another system can let a user in, without
requiring that system to have data about
who is going in.

> *8It saves a lot of manual work. It also reduces the chance of mistakes. It can also help with limiting the sharing of sensitive information in systems.*

Functionalities & procedures: ### Rational:

ac120 [8(8)]Standards
standardising of connections.

ac121 [8(8)]Make agreements about standards with which
you tie systems together.

> *5Then you can just connect systems. Then it is no longer an issue.*

1) Do you think that you've gotten a grip on the discussed issues? (why?)

2) Have you experienced your participation to the research as useful? (why?)

Hugo van der Zandt
+31611802022
Hugo.vanderzandt@gmail.com
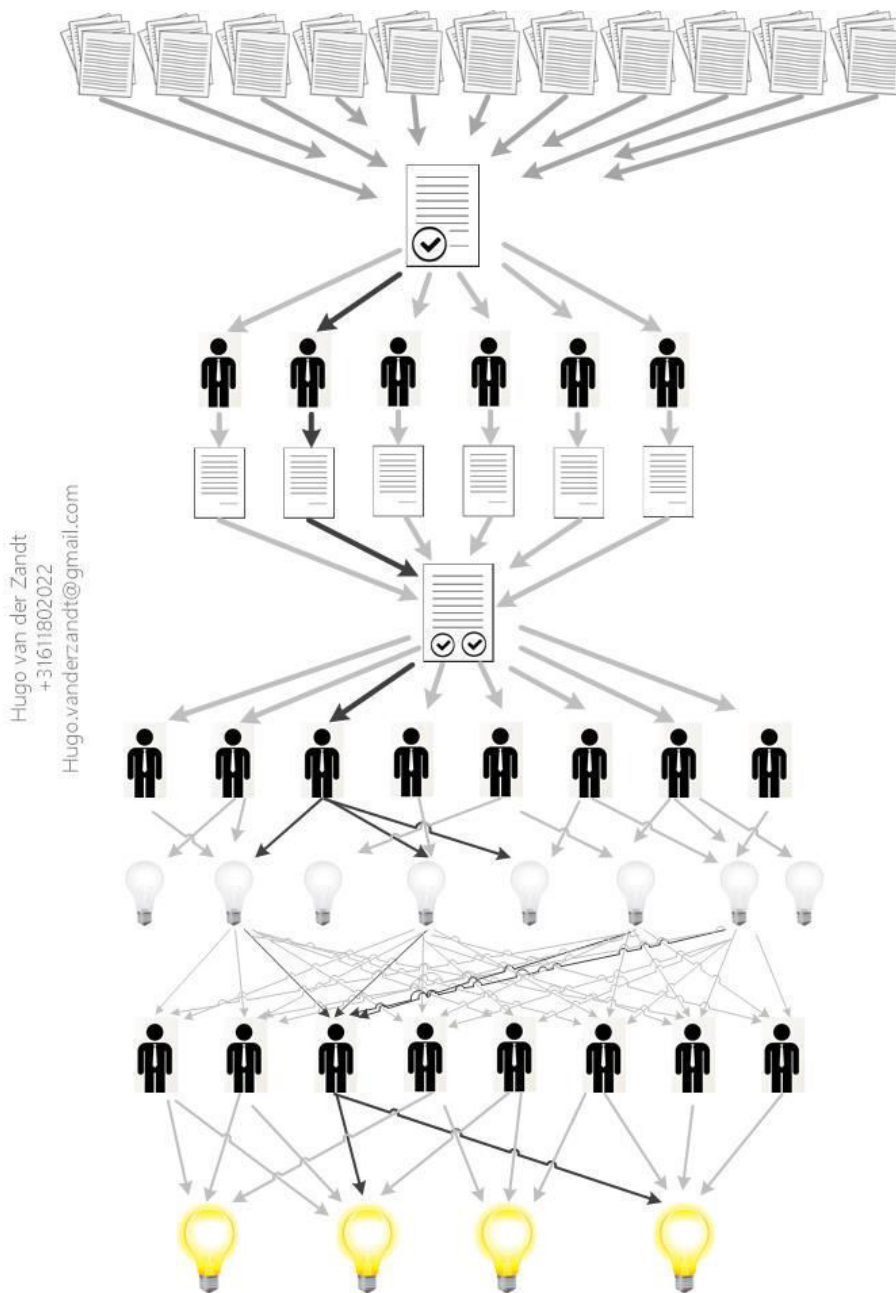
3) The seeing of all of the issues and the input from other participants helps you to come up with solutions. (why yes / why not)

1. Complex network issues

2. Lack of willingness

3. Insufficient mutual understanding

4. Semantic issues

5. Organisational issues

6. Insufficient resources

7. Authorization / data access

8. Legal issues

9. Data quality issues

10. Data integration issues

-----------------End of protocol--------------

Additionally suggested functionalities during round two.
1. Complex network issues

(new1) #5. Chatting (in a shared environment)
It is easy. If you constantly use a shared environment it is an easy way to communicate. You really have to have it open all day, else there is no use.

(new2) #5. A wiki functionality. But everyone has to use it. Just having the technique accomplishes nothing.
Because you can find things on it.

(new3) #6. Smart boards, with these you can -I saw whiteboards- Smart boards can replace those whiteboards.
You can also save those immediately and everyone has access to them, share them, email them and I think that is its main advantage. Everyone can see it and afterwards it's also electronically documented. You can also do presentations on it, it's all in one.

(new4) #8. In addition to that 'idea' functionality, that depending on what people think of it, it gets more or less value. This would enable act on it faster. Some kind of idea bus where you can post ideas, where other users can say if they think it's a good idea or not.
Then you'd be able to say based on the number of likes if you're going to do something with the idea. Now we get ideas on a daily basis, we have to choose which once to follow up on for the users. Sometimes we want to involve them before we start implementing new ideas, but this is very time consuming.

(new5) #1 (talking about electronic conferencing) there are a lot of tools where you can share your desktop.
At some point you want to be able to share things, these can be documents or a movie, at the moment that you can share your desktop you can make all of the information that you have available to yourself available to someone else.

2. Lack of willingness

(new6) #2. Mobile, the: anywhere- anytime- anyhow- principle.
All of the mentioned functionalities are substantive solutions. But if I have to get behind a desktop PC for all of those, my willingness could be less than if I could also do it on the train on my cell phone. So the reachability and availability of those systems is crucial. (Not to be confused with user-friendliness. It is the availability of access, the low threshold to start using it)

3. Insufficient mutual understanding

(new7) #8. A different form of a periodic evaluation, where the networks looks at one casus. Everyone prepares for it. Not so much an ICT functionality but a procedure where you discuss a customer case.
Because then you can go through a process step by step. If you let please write a blog or story it will stay quite general. I think that if you take a case you can go deeper.

7. Authorization / data access

(new8) #5. Newsletters, we send out newsletters every week to our partners.
It is very useful, it's good for the relation with partners. If we are planning some changes we send out beautiful newsletters. These can include good new but also bad news.

8. Legal issues

(new9) #5. A signal when a retention period is about to end, telling someone to take action.
Automatically doing this sounds dangerous.

9. Data quality issues

(new10) #8. ICT can be used to make data anonymous.
This way it can be analysed.

10. Data integration issues

(new11) #5. Connections hubs, those are called REST servers no? Is that what they are called?

Definitions of functionality types

ICT functionality type	Description	Included ICT functionalities.
Tools that facilitate working remotely (Main category of ICT functionality types)		
Tools that facilitate working remotely	*Functionalities such as email, conferencing and digital reports.*	u83
General ICT functionalities		
A shared online environment	*A shared online environment in which people can collaborate through communicating and documenting.*	c2, j21, l29, r58, u74, w89
Increasing accessibility of information	*ICT can increase the ease of access to information. By making information more accessible it is more likely that the information reaches the intended audience.*	new6, new8
Unique functionalities		
E-learning	*Videos, short texts and questions to practice with.*	r65
Mind map techniques	*To be used with brainstorm sessions. People can provide input up front and create a mind map together to structure information.*	j20
Communication support		
Real time communication	*Digital means to communicate real-time with others, while being able to see and hear them. Such as videoconferencing. This communication can be supported by various types of content sharing (such as a shared desktops and white/smart–boards).*	c13, c14, c15, c16, r60, r66, r67, r68, r69, r70, new3, new5
Gamification	*Motivating people to share knowledge with playful incentives.*	j23, r72
Locating knowledge	*ICT can help with finding people that possess certain knowledge.*	j19, l38, r62, u80
Forum functionality	*An online forum where people can leave messages and expert responses from others.*	c5, c6, c7, c12, j22, j24, j27, l34, l35, l36, r59, new1, new4
Process support		
Task management	*Being able to define tasks that have to be completed.*	c9, o53, r57, u75, u76
Making appointments	*ICT can provide calendar functionalities which support making appointments.*	c10, c11
Document management systems (two sub categories)		
Document management systems	*Document managements systems combine functionalities related to making knowledge explicit.*	l33
Documentation		
Documentation	*ICT can be used to document things such as: knowledge, agreements, best practices, FAQ, and guidelines.*	c3, j25, l30, l31, l32, l37, l39, n43, n44, n45, n46 o49, o50, o51, o52, o54, o55, o56, r61, r63, r64, u77, u78, w89, w90, new2
Data / document management		
Version control	*ICT can be used to provide version control. I.e. making the sure that updated material does not have conflicts with other updated material.*	c10
Adherence to and application of laws and regulations	*ICT can be used to support adherence to laws and regulations (such as retention periods). ICT can also be used to support application of laws and regulations*	w91, w93, w95, new9

	through making and singing agreements.	
Authorization	ICT can be used to manage which individuals have access to data and systems.	c4, u79, w92, w94, w97, ac119
Anonymization of data	Data can be made anonymous, this way it can be shared with partners without disclosing sensitive information.	new10
Clarify definitions	ICT can be used to align definitions and prevent semantic issues.	n42, z100, z106, z107, z108
Data input quality	ICT can be used to facilitate completeness and correctness of data through making data entry fields mandatory and perform checks on input.	z98, z99, z101, z102, z103, z104, z105
System integration related functionalities		
Connecting Systems	ICT can be used to connect systems to each other, such as means to access systems information inside of systems or send data to systems.	c17, ac112, ac114, ac115, ac116, ac120, new11
Data exchange between systems	ICT can be used to load and transform data from one system and make it useable by other systems.	ac111, ac113, ac117, ac118
Non ICT solutions		
Processes and agreements	Collaborations can be supported through making agreements about how to use ICT in various activities.	c18, j26, r71, u82, z109, z110, ac121, new7
Trust and relations	Maintaining a good relationship between partners can facilitate collaboration.	j28, l40, l41, n47, n48, u84, u85, u86, u87, u88
Hire new staff	This way collaboration activities with partners can be delegated.	r73

Participant quotes

This section contains quotes of the participants, with which they answered the questions at the end of the second Delphi round. These quotes have been translated from Dutch to English. The quests are listed in such a way that similar answers are positioned close to each other.

1) Do you think that you've gotten a grip on the discussed issues? (why?)

#6 "Yes I do think so. But this is also because we're quite far into this area ourselves. [...] I also see things of which I think 'hey, we can do more with this'."

#4 "we've spend a total of 4 hours on it in total through the interviews that we've had. This does make me think about it: 'Another party has described it like that, maybe we can learn from that'. So I do think so yes."

#5 "I already had a grip on what I was doing [...] if I go through this (document) the main red line is just one central system. And I already use a central system."

#7 "most issues yes, we have a guideline for communication, we have central environments where we share information, we do all of that well, data integration, data quality but data management in general, that is an exciting one."

#2 "I think this research creates some extra awareness. [...] But I find 'grip' a too large word. Because that would imply that through answering a few questions I all of a sudden got grip over some problem. For me there is also some kind of action element attached to it, and I'm not that far yet. [...] So it's more about

insight." *Interviewer: "Ok, I think that also answers the why question."* #2 "Yes! Why: because of that insight and just thinking about it for once. So I also really expect that I can do something with the results."

#1 "there are nice ideas in there... but they still have to be made, only then we have grip on it [...]. There should be companies that see an opportunity here and start developing this and then I might be interested in using it to solve certain things."

#3 "The problem in a network is more related to the interpersonal relations, trust and a communication issue. and you don't solve that with ICT. [...] Instrumentally speaking, anything that facilitates is nice to have. But it only facilitates. [...] There are a lot of aids you can employ but with these things you don't solve the real collaboration problem. That is a social-human problem and that does not come to the surface enough here."

#8 "Yes I think so. I also think that I see possibilities for a lot of the solutions. But I am still a little bit skeptical when it comes to using systems for solving problems. There has to be a need for it and it has to be used."

2) Have you experienced your participation to the research as useful? (why?)

#8 "The support of ICT is not something we think about daily. So yes, it has certainly been useful."

#6 "Yes, because I do see that you have a lot of organized information, so I'm very curious about the end result."

#4 "I think now it's easy to see what is important for us and what isn't. And we are pleased with that."

#2 "Yes, because it gives me insights."

#7 "All of those other things we already do [...] all of those things that are listed here, I can show you those. [...] perhaps other participants overlooked something or because I overlooked something. So that I think 'oh yeah, I didn't think of that yet.' I think that is the most important."

#5 "in the end what comes it 'make sure you collaborate with some kind of tool' but we have internet for that. What I'm trying to say is, not much changes for me."

#3 "I think it forced me to formulate a couple of things that implicitly run through my head. With that you don't solve my problems." *Interviewer: "did you experience that as something useful, to do?"* #3 "I think that the communication has been useful."

#1 "I do find it a nice method. I find it useful in the sense that it also inspired me, not so much for this problem [...] I do think that an approach like this could be useful. So in that sense it was useful."

3) The seeing of all of the issues and the input from other participants helps you to come up with solutions. (why yes / why not)

#8 "Yes such a process helps for sure. If you would have asked me these things at the beginning I would not have been able to come up with anything, or perhaps very little [...] it also helps to see the input from others."

#6 "Yes, to get insights and transparency in what the options are. [...] it surely helps in the categorizing, framing and seeing what kind of options are available. [...] sometimes an "aha erlebnis" (obtaining new insights) as the Germans call it. And sometimes I think 'hey, we should also do something with that over here'."

#4 "I think you made the right steps in that in your research. First frame it and then checking 'hey is this it', then we check it and we end up with 10 issues. I think that is very good."

#2 "So 'does it help you to think of solutions': yes. And for sure that I will have a look at this together with a consultant. To go through this list. To see if these are things to which we can contribute for our customers. [...] So the answer is 'yes'. And the 'why' is because I do see things which I can plot on what we do."

Interviewer: "But the question that we'd like answered is, if you don't have a list of issues. Would you still be able to come up with such a collection of functionalities? Could you think of those?" #7 "Oh then, I don't think so. You always have to do this. Then that mind mapping starts peeking around the corner. If we sit together and look at: what are the aspects that touch us, that we should have an opinion about. Then it is very convenient if you show up with such a list. [...] what you should actually also do is, [...], is making choices and assign priorities because you can't do everything at once. [...] t (van Beek, 2015)his also gives a nice occasion to make steps towards becoming a better organization. To be more in control."

#5 "about the research [...] the way you do that: asking questions and stuff, that can be separated from the contents of your research, you can use that for something completely different. I really like that process."

#3 "Look, the proposed solutions that passed by have been instrumental, those are there and you do see those. [...]" *interviewer "do you think that the process, first that framing of a list of 29 issues, of those pick the most relevant once and discussing those in this way, in two rounds?"* #3 "That is possible, but you take it in a direction that I would not choose myself. That's where it creates friction for me.[...] with less emphasis on ICT I would have probably gotten more out of this [...]. Put the emphasis on the business... Perhaps that's even more important also for the alignment because then you can also put emphasis on the 'don'ts'."

#1 "I do think it is effective. But like I already said, you're looking at ICT solutions but we're not the once to start developing those. So yeah, I do think it is useful for coming up with the solutions but you still need someone to stand up and start offering them. So yes, it is useful to see it."

Discovering ICT solutions for knowledge transfer issues in co-creation value networks

A multiple case study and Delphi study combined